UNITED STATES GOVERNMENT
MEMORANDUM

March 20, 2018

To: Public Information (MS 5030)
From: Plan Coordinator, FO, Plans Section (MS 5231)

Subject: Public Information copy of plan

Control #	-	R-06668
Type	-	Revised Development Operations Coordinations Document
Lease(s)	-	OCS-G17565 Block - 857 Alaminos Canyon Area
Operator	-	Shell Offshore Inc.
Description	-	Subsea Wells GD002 and GD002-Alt
Rig Type	-	Not Found

Attached is a copy of the subject plan.

It has been deemed submitted as of this date and is under review for approval.

Michelle Griffitt
Plan Coordinator

Site Type/Name	Botm Lse/Area/Blk	Surface Location	Surf Lse/Area/Blk
WELL/GD002	G17565/AC/857	5869 FSL, 6868 FEL	G17565/AC/857
WELL/GD002ALT	G17565/AC/857	6889 FSL, 6868 FEL	G17565/AC/857

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Public Information Copy

January 30, 2018

Mrs. Michelle Picou, Section Chief
Bureau of Ocean Energy Management
1201 Elmwood Park Boulevard
New Orleans, LA 70123-2394

Attn: Plans Group MS GM235D

SUBJECT: Revised Development Operations Coordination Document (DOCD/SDOCD)
OCS-G 17565, Alaminos Canyon Block 857
Alaminos Canyon Unit No. 754308001
Plan Control No. R-5144, S-7322 and S-7846
Offshore, Texas

Dear Mrs. Picou:

In compliance with 30 CFR 550.242 and NTLs 2008-G04, 2009-G27 and 2015-N01, giving DOCD guidelines, Shell Offshore Inc. (Shell) requests your approval of this revised DOCD to move wells GD002 and GD002-alt greater than 500'. In support of this request, we are providing the following cd: "*Shallow Hazards, Multi-Temporal Subsidence Monitoring, and Archaeological Assessment, Perdido Field, Block 857 & Vicinity, Alaminos Canyon Area, Gulf of Mexico, August 2015*" by Fugro Geoservices, Job No. 2414-5056.

Should you require additional information, please contact Tracy Albert at 504.425.4652 or tracy.albert@shell.com.

Sincerely,

Sylvia A. Bellone
Sr. Regulatory Specialist

Attachments

SECTION 1 – PLAN CONTENTS

A. DESCRIPTION, OBJECTIVES & SCHEDULE

Shell Offshore Inc. (Shell) is submitting this revision to Plans R-5144, S-7322 and S-7846 for Alaminos Canyon (AC) Block 857 to move two wells (GD002 and GD002-Alt) greater than 500' and allow for future drilling and well work on these wells.

The proposed rig will be either a dynamically positioned (DP) semi-submersible (Atwood Condor or similar) or a Drill Ship (Noble Don Taylor or similar); both are self-contained drilling vessels with accommodations for a crew which include quarters, galley and sanitation facilities. The rigs will comply with the requirements in the Interim Final Rules. The drilling activities will be supported by the support vessels and aircraft as well as onshore support facilities as listed in Sections 14 and 15 of the RDOCD R-5144. Shell has employed or contracted with trained personnel to carry out its exploration activities. Shell is committed to local hire, local contracting and local purchasing to the maximum extent possible. Shell personnel and contractors are experienced at operating in the Gulf of Mexico and are well versed in all Federal and State laws regulating operations. Shell's employees and contractors share Shell's deep commitment to operating in a safe and environmentally responsible manner.

Shell, through its parent and affiliate corporations, has extensive experience safely exploring for oil and gas in the Gulf of Mexico. Shell will draw upon this experience in organizing and carrying out its drilling program. Shell believes that the best way to manage blowouts is to prevent them from happening. Significant effort goes into the design and execution of wells and into building and maintaining staff competence. In the unlikely event of a spill, Shell's Regional Oil Spill Response Plan (OSRP) is designed to contain and respond to a spill that meets or exceeds the worst case discharge (WCD) as detailed in Section 9 of plan R-5144. The WCD does not take into account potential flow mitigating factors such as well bridging, obstructions in wellbore, reservoir barriers, or early intervention. We continue to invest in research and development to improve safety and reliability of our well systems. All operations will be conducted in accordance with applicable federal and state laws, regulations and lease and permit requirements. Shell will have trained personnel and monitoring programs in place to ensure such compliance.

B. LOCATION

See attached BOEM forms included in this section.

C. Rig Safety and Pollution Features

The rig (Atwood Condor or similar or Noble Don Taylor or similar) will comply with all of the regulations of the American Bureau of Shipping (ABS), International Maritime Organization (IMO) and the United States Coast Guard (USCG). All drilling operations will be conducted under the provisions of 30 CFR, Part 250, Subpart D and other applicable regulations and notices, including those regarding the avoidance of potential drilling hazards and safety and pollution prevention control. Such measures as inflow detection and well control, monitoring for loss of circulation and seepage loss and casing design will be our primary safety measures. Primary pollution prevention measures are contaminated and non-contaminated drain system, mud drain system and oily water processing.

The following drain items are typical for rigs in Shell's fleet.

DRAIN SYSTEM POLLUTION FEATURES

Drains are provided on the rig in all spaces and on all decks where water or oil can accumulate. The drains are divided into two categories, non-contaminated and contaminated. All deck drains are fitted with a removable strainer plate to prevent debris from entering the system.

Deck drainage from rainfall, rig washing, deck washing and runoff from curbs and gutters, including drip pans and work areas, are discharged depending on if it comes in contact with the contaminated or non-contaminated areas of the Rig.

1) Non-contaminated Drains

Non-contaminated drains are designated as drains that under normal circumstances do not contain hydrocarbons and can be discharged directly overboard. These are mostly located around the main deck and outboard in places where it is unlikely that hydrocarbons will be found.

Drains within 50 feet of a designated chemical storage area which uses the weather deck as a primary containment means shall be designated "normally plugged." An adequate number of drains around the rig shall be designated as "normally open" to allow run-off of rain water. Normally open drains shall have a plug located in a conspicuous area near the drain which can be easily installed in the event of a spill.

The rig's drain plug program consists at a minimum of a weekly check of all deck drains leading to the sea to verify that their status is as designated. If normally-open, they shall verify that the drain is open and that the plug is available in the area. If normally-closed, they shall verify that the plug is securely installed in the drain.

In the event a leak or spill is observed, the event shall be contained (drain plug installation and/or spill kit deployment as appropriate) and reported immediately.

Rig personnel shall ensure that the perimeter kick-plates on weather decks are maintained and drain plugs are in place as needed to ensure a proper seal.

2) Contaminated Drains

Contaminated drains are designated as drains that contain hydrocarbons and cannot be discharged overboard. When oil-based mud is used for drilling it will have to be collected in portable tanks and sent to shore for processing.

3) Mud Drain System

None

4) Oily Water Processing

Oily water is collected in an oily water tank. It must be separated and not pumped overboard until oil content is <15 ppm. The separated oil is pumped to a dirty oil tank and has to be sent ashore for disposal. On board the MODU an oil record log has to be kept according to instructions included in the log. Any and all pollution pans are subjected to a sheen test before being pumped out. If the water passes the sheen test then it is pumped overboard. If it does not pass the sheen test then the water/oil mixture is pumped to a dirty oil tank and sent to shore for disposal. All waste oil that is sent in to be disposed of is recorded in the MODU's oil log book.

All discharges will be in accordance with applicable NPDES permits. See Section 18, EIA.

5) Lower Hull Bilge System

- The main bilge system is designed to drain the pontoons. There are Goulds electrically driven, self-priming centrifugal pumps - one for each main pump room. The aux pumps can be pump out with the bilge pump but has to be lined up manually from the main pump room.
- Bilge water is pumped overboard after a sheen test has been completed.
- The pontoon bilge pumps are operable from the Bridge and have audible and visual bilge alarms set for high and low levels.
- Portable submersible pumps are carried onboard the rig to service all column void spaces and are also used for emergency bilge pumps in the event of the main pump room flooding.
- Alternate means of pumping the bilges in each pontoon pump room include the use of:
  - The ballast system emergency bilge valve which is operated from the control panel.
  - Portable submersible pumps
  - Emergency bilge suction line connected directly to the ballast manifold. (Main Pump rooms only)

The Bilge pumps are manual/automatic type pumps. They are equipped with sensors that give a high and a high- high alarm. They are set to a point at which the water gets to a certain point they will automatically turn on to pump water out in order to keep flooding under control. The pumps are also capable of being put in manual mode in which they can be turned on by hand.

6) Emergency Bilge System

Main ballast pumps may also be used for emergency bilge pumping directly from the pump rooms via remotely actuated direct bilge suction valves on the ballast system. These valves will operate in a fully flooded compartment. The ballast pumps can be supplied from the emergency switchboard.

7) Oily Water Drain/Separation System

Oily water/engine room bilge water is collected in an oily water tank. It must be separated and not pumped overboard until oil content is <15 ppm. The separated oil is pumped to a dirty oil tank and has to be sent ashore for disposal. On board all drilling Units, an oil record log has to be kept according to instructions included in the log. The rig floor has two skimmer tanks and each is subjected to a sheen test before pumping overboard to ensure environmental safety. All three anchor winch windlasses have skimmer tanks and are subjected to sheen tests before discharge as well.

8) Drain, Effluent and Waste Systems

- The rig's drainage system is designed in line with our environmental and single point discharge policies. Drains are either hazardous, i.e. from a hazardous area as depicted on the Area Classification drawings, or non-hazardous drains from nonhazardous areas.
- To prevent migration of hazardous materials and flammable gas from hazardous to non-hazardous areas, the drainage systems are segregated.
- The rig drainage systems tie into oily water separators that take out elements in the drainage that could harm the environment. This is part of Noble's initiative to be good stewards of the environment.

9) Rig Floor Drainage

The rig floor is typically outfitted with a Facet International MAS 34-3 separator. The separator has coalescent plates that remove the solids from the drainage and the remaining drainage goes to a skimmer tank. From the skimmer tank it is drained to one of the column dirty oil tank systems where it is then sent through 2 separators and cleaned further to reduce oil content to less than 15 ppm.

10) Columns #3 & 4

The drains on the decks and machinery spaces are separated at mid ship and directed to either the #3 or #4 columns. The separators in these columns go through three cycles of circulation and remove oil to <15 ppm, then discharge the clean product to sea.

11) Main Engine Rooms

The engine rooms have their own drainage and handling system. The engine rooms are outfitted with a dirty oil tank and the drainage in the tank is processed through the separator, the waste from the separator goes back to the dirty oil tank and the clean water (<15 ppm) goes overboard.

12) Helideck Drains

The helideck has a dedicated drainage system around its perimeter to drain heli-fuel from a helicopter incident. The fuel can be diverted to the designated heli fuel recovery tank which is located under the Helideck structure.

Operating configurations are as follows:

- The overboard piping valves and hydrocarbons take on valves are closed and locked. To unlock overboard or take on valves a permit has to be filled out.
- The oily water collection tank overflow valve is closed.
- The drill floor drains are lined-up to the drill floor skimmer tank. The skimmer tanks have a high alarm which sounds by means of an air horn. Before tanks are pumped out a sheen test is performed. Water is pumped out the skimmer tanks down the shunt line. Oil containment side is pumped out into 550 gal tote tanks.
- The BOP test area drains are normally lined-up to drain overboard.
- The oily water separator continuously circulates the oily water collection tank. Waste oil is discharged into the waste oil tank and oily water is re-circulated back into the oily water collection tank. Clean water is pumped overboard, which is controlled/monitored by the oil content detector, set at 15 ppm.
- The solids control system is capable of being isolated for cuttings collection.
- The bilge system is normally pumped directly overboard after a sheen test has been performed.
- The engine dirty oil sump can be drained down in port column oily water separator which discharges water overboard from the water side and oil being pumped out into a 550 gal tote tank oil containment side. There is a high audible alarm on the ballast control panel.

D. Storage Tanks – Atwood Condor DP Semi-Submersible or similar:

Type of Storage Tank	Type of Facility	Tank Capacity (bbls)	Number of Tanks	Total Capacity (bbls)	Fluid Gravity (Specific)
Diesel Tank in stbd 1 80% fill in all hull tanks	Drilling Rig	3597	1		Marine Diesel (0.91 SG)
Diesel Tank in stbd 2	Drilling Rig	2713	1		Marine Diesel (0.91 SG)
Diesel Tank in stbd 3	Drilling Rig	3456	1		Marine Diesel (0.91 SG)
Diesel Tank in stbd 4	Drilling Rig	653	1		Marine Diesel (0.91 SG)
Diesel Tank in port 1	Drilling Rig	2090	1		Marine Diesel (0.91 SG)
Diesel Tank in port 2	Drilling Rig	1366	1		Marine Diesel (0.91 SG)
Diesel Tank in port 3	Drilling Rig	4787	1		Marine Diesel (0.91 SG)
Diesel Tank in port 4	Drilling Rig	3456	1		Marine Diesel (0.91 SG)
Total storage in hull tanks	Drilling Rig			22118	Marine Diesel (0.91 SG)
Diesel Settling Tanks	Drilling Rig	129	1		Marine Diesel (0.91 SG)
Diesel Settling Tanks	Drilling Rig	129	1		Marine Diesel (0.91 SG)
Diesel Settling Tanks	Drilling Rig	139	1		Marine Diesel (0.91 SG)
Diesel Settling Tanks	Drilling Rig	129	1		Marine Diesel (0.91 SG)
Diesel Day Tank	Drilling Rig	100	1		Marine Diesel (0.91 SG)
Diesel Day Tank	Drilling Rig	115	1		Marine Diesel (0.91 SG)
Diesel Day Tank	Drilling Rig	114	1		Marine Diesel (0.91 SG)
Diesel Day Tank	Drilling Rig	115	1		Marine Diesel (0.91 SG)
Total engine room diesel	Drilling Rig			970	Marine Diesel (0.91 SG)
Lube Oil Tank	Drilling Rig	86.25	4	345	Lube Oil (0.91 SG)

Storage Tanks – Noble Don Taylor Drillship or similar:

Type of Storage Tank	Type of Facility	Tank Capacity (bbls)	Number of Tanks	Total Capacity (bbls)	Fluid Gravity (Specific)
Fuel oil	Drilling Rig	2,889	4	11,556	Marine Diesel (0.91 SG)
Fuel oil	Drilling Rig	3,225	4	12,900	Marine Diesel (0.91 SG)
Fuel oil	Drilling Rig	2,887	4	11,548	Marine Diesel (0.91 SG)
Fuel oil	Drilling Rig	2,680	4	10,720	Marine Diesel (0.91 SG)
Fuel oil	Drilling Rig	178	8	1,424	Marine Diesel (0.91 SG)

E. Pollution Prevention Measures

Pursuant to NTL 2008-G04 the proposed operations covered by this plan do not require Shell to specifically address the discharges of oil and grease from the rig during rainfall or routine operations. Nevertheless, Shell has provided this information as part of its response to 1(c) above.

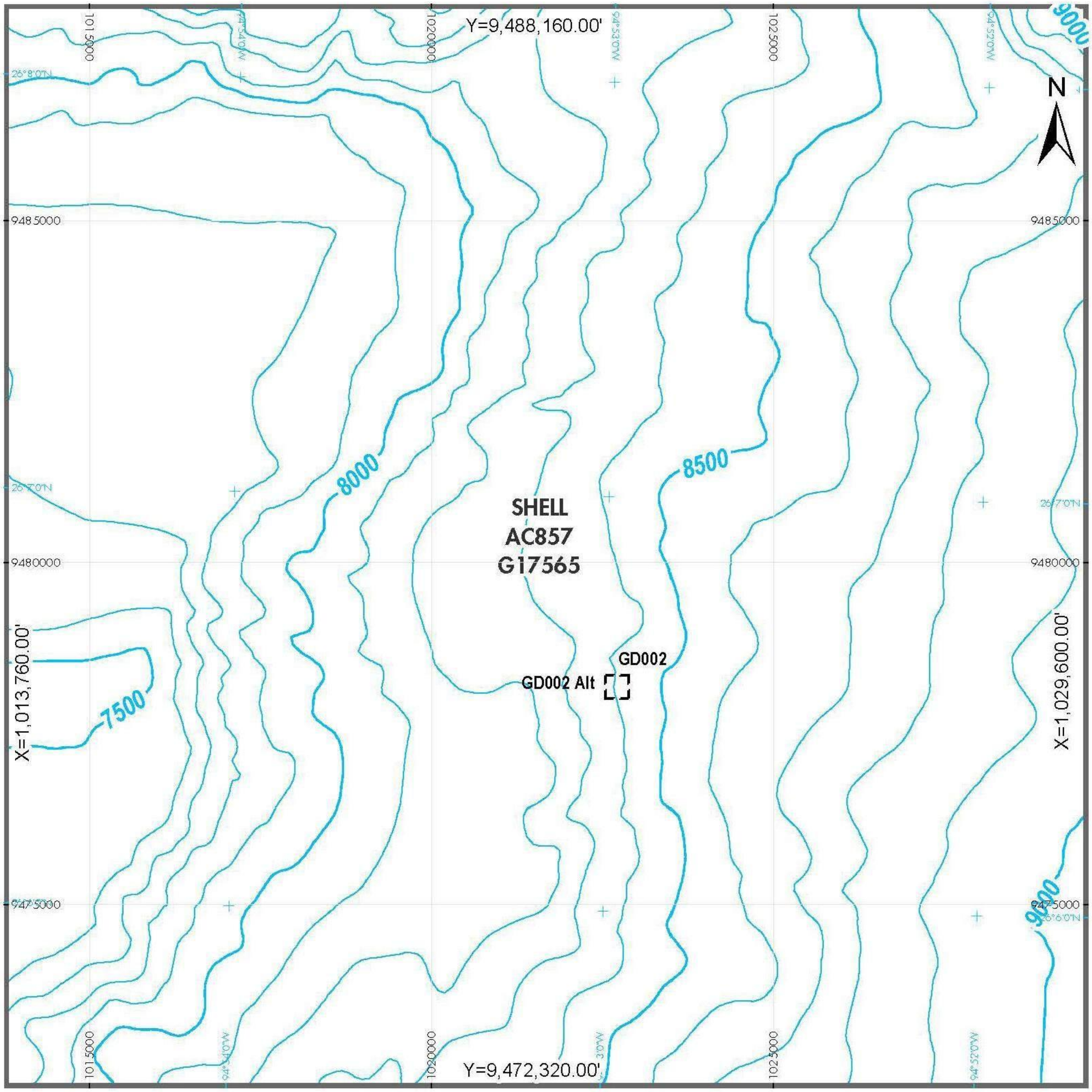
F. Additional Measures

- HSE (health safety and environment) are the primary topics in pre-tour and pre-job safety meetings. The discussion around no harm to people or environment is a key mindset. All personnel are reminded daily to inspect work areas for safety issues as well as potential pollution issues.
- All tools that come to and from the rig have their pollution pans inspected, cleaned and confirmation of plugs installed prior to leaving dock and prior to loading on the boat.
- Preventive maintenance of rig equipment includes visual inspection of hydraulic lines and reservoirs on routine scheduled basis.
- All pollution pans on rig are inspected daily.
- Containment dikes are installed around all oil containment, drum storage areas, fuel vents and fuel storage tanks.
- All used oil and fuel is collected and sent in for recycling.
- Every drain on the rig is assigned a number on a checklist. The checklist is used daily to verify drain plugs are installed.
- All trash containers are checked and emptied daily. The trash containers are kept covered. Trash is disposed of in a compactor and shipped in via boat.
- The rig is involved in a recycling program for cardboard, plastic, paper, glass and aluminum.
- Fuel hoses and SBM are changed on annual basis.
- TODO spill prevention fittings are installed on all liquid take on hoses.
- Waste paint thinner is recycled on board with a solvent still to reduce hazard of shipping and storage.
- All equipment on board utilizes Envirorite hydraulic fluid as opposed to hydraulic oil.
- Shell has obtained ISO14001 certification.
- Shell uses low sulfur fuel.

G. Description of Previously Approved Lease Activities

Not required in GoM.

Attachment 1A
Bathymetry and Surface Locations



MAP INFORMATION

Legend

- Proposed Surface Location
- Bathymetric Contour (Index)
- Bathymetric Contour (Intermediate)
- Shell Lease Block
- Graticule Grid Tick
- Measured Grid Line

Proposed Surface Locations

GD002	6,868.00' FEL & 5,869.00' FSL of Blk. 857 X=1,022,732.00' Y=9,478,189.00'
GD002 Alt	6,868.00' FEL & 6,889.00' FSL of Blk. 857 X=1,022,711.00' Y=9,478,173.00'

MAP SCALE

0 1,000 2,000 4,000 Feet

1:24,000

Print size: 8.5"x11" (ANSI A)

SHELL OFFSHORE INC.

Revised D.O.C.D.

Gulf of Mexico

Alaminos Canyon Block 857

Proposed Surface Locations

GEODETIC PARAMETERS

Horizontal Coordinate Reference System
CRS name (ESRI): NAD 1927 BLM Zone 15N (US Feet)
CRS name (Shell): NAD27 / BLM 15N (ftUS)
CRS code (EPSG): 32065
Geodetic datum: North American 1927
Projection name: Transverse Mercator
Horizontal units: Foot US

Author: T. Albert / D.G. Oalmann	Date: April 21, 2017
Reviewed By: S. Long	EP Catalog No.: EP201704202434001

G:\30_Project\CAD_NewOrleans\Maps\Permit Plats\Great White\Great White Proposed Surface Locations DOCD Jan2018.mxd

Attachment 1B
Bottom-Hole Locations – GD002 & GD002-Alt

Proprietary Data

U.S. Department of the Interior
Bureau of Ocean Energy Management

Attachment 1C
OCS PLAN INFORMATION FORM

General Information				
Type of OCS Plan:		Exploration Plan	Development Operations Coordination Document (DOCD)	X

Company Name: Shell Offshore Inc.	BOEM Operator Number: 0689
Address: 701 Poydras St., Room 2418	Contact Person: Tracy Albert
New Orleans, LA 70131	Phone Number: 504.425.4652
	Email Address: tracy.albert@shell.com

If a service fee is required under 30 CFR 550.125(a) provide:	Amount Paid: NA	Receipt No. NA

Project and Worst Case Discharge (WCD) Information			
Lease(s) OCS-G 17565	Area: AC	Block(s): 857	Project Name: Frio - Great White Unit

Objectives(s):	X	Oil		Gas		Sulphur		Salt	Onshore Support Base(s) Fourchon & Galveston

Platform/Well Name: GA014	Total Volume of WCD: 129,000 BOPD	API Gravity: 34°
Distance to Closest Land (Miles): 142	Volume from uncontrolled blowout: 5.4 MMBBL	

Have you previously provided information to verify the calculations and assumptions of your WCD?	X	Yes		No
If so, provide the Control Number of the EP or DOCD with which this information was provided	R-5144			
Do you propose to use new or unusual technology to conduct your activities?		Yes	X	No
Do you propose to use a vessel with anchors to install or modify a structure?		Yes	X	No
Do you propose any facility that will serve as a host facility for Deepwater subsea development?		Yes	X	No

Description of Proposed Activities and Tentative Schedule (Mark all that apply)

Proposed Activity	**Start Date**	**End Date**	**No. of Days**
Exploratory drilling			
Development drilling	See attached		
Well completion	See attached		
Well test flaring (for more than 48 hours)			
Installation or modification of structure			
Installation of production facilities			
Installation of subsea wellheads and/or dry hole tree	See attached		
Installation of lease term pipelines	See attached		
Commence production	See attached		
Other (Specify and attach description) Future well work	See attached		

Description of Drilling Rig				**Description of Structure**			
	Jackup	x	Drillship		Caisson		Tension Leg Platform
	Gorilla Jackup		Platform rig		Fixed Platform		Compliant Tower
	Semisubmersible		Submersible	X	Spar Other		Guyed tower
x	DP Submersible		Other (attached description)		Floating production system		Other (attached description)

Drilling Rig Name (If known): Noble Don Taylor or similar, Atwood Condor or Similar

Description of Lease Term Pipelines

From (Facility/Area/Block)	To (Facility/Area/Block)	Diameter (Inches)	Length (Feet)
AC 857	AC857	15.09” OD	2196’

Attachment 1C.1 Schedule

Schedule to drill, complete and install tree:

Well	Start date	Duration	End date
GD002	4/1/2018**	200	10/18/2018
Install jumper	10/18/2018	18	11/05/2018
Commence production	11/6/2018		
GD002-Alt	1/1/2019***	200	7/20/2019
Install jumper	7/21/19	18	8/8/2019
Commence production	8/9/2019		
*Future well work	2020	200/10 years	2030

* Future well work for GD002 and GD002-Alt. GD001, GD003, GD003-Alt and GD004 are covered in separate RDOCD.

*The days for future well work will not exceed the 200 days per year as listed above.
**The schedule and AQR for 2018 includes the activities for the GD003 (or GD003-Alt if well is lost) well from Plan R-6665.
***The schedule and AQR for 2019 includes the activities for the GD004 well from Plan R-6665.
Note: The GB wells in Plan R-5144/R6297 will not be drilled in 2018-2019.

Attachment 1D

<table>
<tr><th colspan="8">Proposed Well/Structure Location</th></tr>
<tr><td colspan="4">Well or Structure Name/Number (if renaming well or structure, reference previous name): GD002</td><td colspan="2">Previously reviewed under an approved EP or DOCD S-7322</td><td>X Yes</td><td>No</td></tr>
<tr><td>Is this an existing well or structure?</td><td>Yes</td><td>X No</td><td colspan="3">If this is an existing well or structure, list the Complex ID or API Number:</td><td colspan="2">NA</td></tr>
<tr><td colspan="6">Do you plan to use a subsea BOP or a surface BOP on a floating facility to conduct your proposed activities?</td><td>X Yes</td><td>No</td></tr>
<tr><td>WCD Info</td><td>For wells, volume of uncontrolled Blowouts (bbls/day): 129,000 BOPD</td><td colspan="2">For structures, volume of all storage and pipelines (bbls): NA</td><td>API Gravity of fluid</td><td colspan="3">34°</td></tr>
<tr><td></td><td>Surface Location</td><td colspan="2">Bottom Hole Location (for Wells)</td><td colspan="4">Completion (for multiple enter separate lines)</td></tr>
<tr><td>Lease Number</td><td>OCS-G 17565</td><td colspan="2">OCS-G 17565</td><td colspan="4">OCS
OCS</td></tr>
<tr><td>Area Name</td><td>Alaminos Canyon</td><td colspan="2">Alaminos Canyon</td><td colspan="4"></td></tr>
<tr><td>Block No.</td><td>857</td><td colspan="2">857</td><td colspan="4"></td></tr>
<tr><td rowspan="2">Blockline Departure (in feet)</td><td>N/S Departure: 5,869′ FSL</td><td colspan="2"></td><td colspan="4">N/S Departure:
N/S Departure:</td></tr>
<tr><td>E/W Departure: 6,868′ FEL</td><td colspan="2"></td><td colspan="4">E/W Departure:
E/W Departure:</td></tr>
<tr><td rowspan="2">Lambert X-Y Coord.</td><td>X: 1,022,732</td><td colspan="2"></td><td colspan="4">X:</td></tr>
<tr><td>Y: 9,478,189</td><td colspan="2"></td><td colspan="4">Y:</td></tr>
<tr><td rowspan="2">Lat/Long</td><td>Latitude: 26.1052</td><td colspan="2"></td><td colspan="4">Latitude</td></tr>
<tr><td>Longitude: -94.8821</td><td colspan="2"></td><td colspan="4">Longitude</td></tr>
<tr><td colspan="2">Water Depth (Feet):
8,430′</td><td></td><td></td><td>MD (Feet)</td><td colspan="3">TVD (Feet)</td></tr>
<tr><td colspan="8">Anchor Radius (if applicable) in feet:</td></tr>
</table>

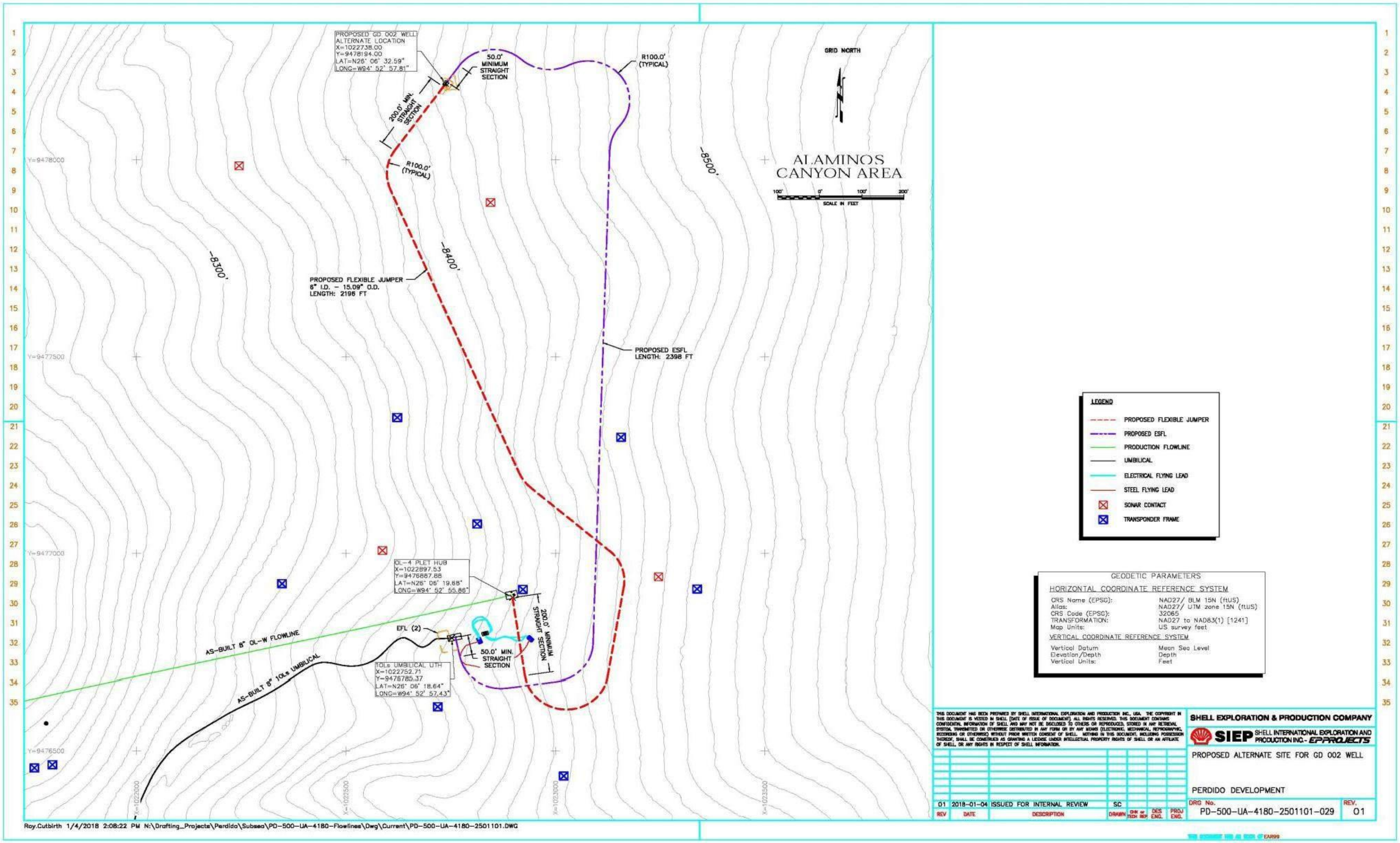
Anchor locations for drilling rig or construction barge (if anchor radius is supplied above, not necessary)					
Anchor Name or No.	Area	Block	X Coordinate	Y Coordinate	Length of Anchor Chain on Seafloor
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	

Attachment 1E

<table>
<tr><th colspan="8">Proposed Well/Structure Location</th></tr>
<tr><td colspan="4">Well or Structure Name/Number (if renaming well or structure, reference previous name): GD002-Alt</td><td colspan="2">Previously reviewed under an approved EP or DOCD?</td><td>Yes</td><td>X No</td></tr>
<tr><td>Is this an existing well or structure?</td><td>Yes</td><td>X No</td><td colspan="3">If this is an existing well or structure, list the Complex ID or API Number:</td><td colspan="2">NA</td></tr>
<tr><td colspan="6">Do you plan to use a subsea BOP or a surface BOP on a floating facility to conduct your proposed activities?</td><td>X Yes</td><td>No</td></tr>
<tr><td>WCD Info</td><td>For wells, volume of uncontrolled Blowouts (bbls/day): 129,000 BOPD</td><td colspan="2">For structures, volume of all storage and pipelines (bbls): NA</td><td colspan="2">API Gravity of fluid</td><td colspan="2">34°</td></tr>
<tr><td></td><td>Surface Location</td><td colspan="2">Bottom Hole Location (for Wells)</td><td colspan="4">Completion (for multiple enter separate lines)</td></tr>
<tr><td>Lease Number</td><td>OCS-G 17565</td><td colspan="2">OCS-G 17565</td><td colspan="4">OCS
OCS</td></tr>
<tr><td>Area Name</td><td>AC</td><td colspan="2">AC</td><td colspan="4"></td></tr>
<tr><td>Block No.</td><td>857</td><td colspan="2">857</td><td colspan="4"></td></tr>
<tr><td rowspan="2">Blockline Departure (in feet)</td><td>N/S Departure: 6,889’ FSL</td><td colspan="2"></td><td colspan="4">N/S Departure:
N/S Departure:</td></tr>
<tr><td>E/W Departure 6,868’ FEL</td><td colspan="2"></td><td colspan="4">E/W Departure:
E/W Departure:</td></tr>
<tr><td rowspan="2">Lambert X-Y Coord.</td><td>X: 1,022,711</td><td colspan="2"></td><td colspan="4">X:</td></tr>
<tr><td>Y: 9,478,173</td><td colspan="2"></td><td colspan="4">Y:</td></tr>
<tr><td rowspan="2">Lat/Long</td><td>Latitude: 26° 06' 19.844"</td><td colspan="2"></td><td colspan="4">Latitude</td></tr>
<tr><td>Longitude: -94° 52' 54.604"</td><td colspan="2"></td><td colspan="4">Longitude</td></tr>
<tr><td colspan="2">Water Depth (Feet):
8,430’</td><td></td><td></td><td colspan="2">MD (Feet)</td><td colspan="2">TVD (Feet)</td></tr>
<tr><td colspan="8">Anchor Radius (if applicable) in feet:</td></tr>
</table>

Anchor locations for drilling rig or construction barge (if anchor radius is supplied above, not necessary)					
Anchor Name or No.	Area	Block	X Coordinate	Y Coordinate	Length of Anchor Chain on Seafloor
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	

Attachment 1F



SECTION 2: GENERAL INFORMATION

A. Application and Permits

There are no individual or site-specific permits other than general NPDES Permit and rig move notifications that need to be obtained. An Application for Permit to Drill (APD) will be submitted and approved by BSEE before drilling operations commence.

B. Drilling Fluids

See Section 7 for drilling fluids and disposal methods of same.

C. Production

Type	Average Production Rate	Peak Production Rate
Oil		
Gas		

Life of reserves – 20 years

D. Oil Characteristics

Characteristic	Analytical Methodologies Should Be Compatible With:
1. Gravity (API) 29°	**ASTM D4052**
2. Flash Point (°C) *	**ASTM D93/IP 34**
3. Pour Point (°C) <29° C	**ASTM D97**
4. Viscosity (Centipoise at 25 °C) 2.771@43 °C	**ASTM D445**
5. Wax Content (wt %)	**Precipitate with 2-butanon/dichloromethane (1 to 1 volume) at -10 °C**
6. Asphaltene Content (wt %) 1.7%	**IP-Method 143/84**
7. Resin Content (wt %) 8%	**Jokuty et al., 1996**
8. Boiling point distribution including, for each fraction, the percent volume or weight and the boiling point range in °C	**ASTM D2892 (TBP distillation) or ASTM D2887/5307**
9. Sulphur (wt %) 2.1%	**ASTM D4294**

Note: If the distillation information in Item No. 8 in the above table is not available, the GOMR may accept the following information in lieu of Items Nos. 5, 6, 7, and 8: weight percent total of saturates, aromatics, waxes*, asphaltenes, and resins; and total BTEX (ppm) using analytical methods compatible with the Hydrocarbon Groups methodology found in Jokuty et al., 1996).

*No Data Available.

All in wt%   Topped Basis

SARA (Topped Basis) All in wt %				
Well #	Saturates	Aromatics	Resin	Asphaltenes
OCS-G-17565 AC857 #1	49.1	43.2	7.6	0.15
OCS-G-17565 AC857 #1 BP1	50.2	41.7	8.0	0.13

Identify the oil you analyze. Refer to the following sample chart.

Oil from one well	Oil from more than one well sampled on a facility	Oil from a pipeline system
·Area/Block-**SeeTable Below** ·MMS platform ·API Well No. ·Completion perforation interval ·MMS's reservoir name ·Sample date ·Sample No.(if more than one is taken)	·Area/Block ·MMS platform ID ·Field/Unit ·Sample date ·Sample No. (if more than one is taken) ·Listing of API Well Nos. ·Storage tank ID No. (if sampled at a storage tank)	·Pipeline segment number ·For each pipeline that feeds into the system, the ID codes for the closest upstream LACT units and/or facility measurement points ·Storage tank ID No. (if sampled at a storage tank)

Sample Detail:

Area/Block	AC857	AC857	AC813	AC813	AC813	AC857
MMS platform	OCS-G-17565#1	OCS-G-17565#1BP#1	OCS-G-17561#1	OCS-G-17561#1	OCS-G-17561#1	OCS-G-17655 #3 & #3ST1
API Well No.	608054001800	608054001801	608054002200	608054002200	608054002200	608054002300
Completion perforation	13834.9 ft MD	13855 ft MD	14899 ft MD	14926.1 ft MD	14952.1 ft MD	14450 ft MD
MMS's reservoir name	WM12	WM12	WM12 (Upper)	WM12 (Middle)	WM12 (Lower)	WM12
Sample date	13-Apr-02	23-Apr-02	5-15-Dec-2002	5-15-Dec-2002	5-15-Dec-2002	1-Nov-03
Sample No.(if more than one is taken)	NG-O-3661A	NG-O-3672A	NG-O-4184	NG-O-4188	NG-O-4201	NG-O-4526A

E. New or Unusual Technology

Shell is not proposing to use new or unusual technology as defined in 30 CFR 250.200 to carry out the proposed activities in this plan.

F. Bonding

The bond requirement for the activities proposed in this EP are satisfied by an area-wide bond furnished and maintained according to 30 CFR Part 256, Subpart I-Bonding; NTL No. 2000-G16, "Guideline for General Lease Surety Bonds" and 30 CFR 256.53(d) and National NTL No. 2016-N01, "Additional Security."

G. Oil Spill Financial Responsibility (OSFR)

Shell Offshore Inc. (Shell), BOEM Operator Number 0689, has demonstrated oil spill financial responsibility for the wells proposed in this plan according to 30 CFR Parts 250 and 253, and NTL No. 2008-N05, "Guidelines for Oil Spill Financial Responsibility for Covered Facilities."

H. Deepwater well control statement

Shell Offshore Inc. (Shell), BOEM Operator Number 0689, has the financial capability to drill a relief well and conduct other emergency well control operations.

I. Suspension of Production

There are no "Suspension of Production" operations proposed for the activities proposed in this plan.

J. Blowout Scenario

This section was previously submitted and accepted by BOEM in R-5085 and R-5144, approved September 1, 2011 for Alaminos Canyon Block 857 Unit (Great White Field), for the AC814 GA014 well. The wells proposed in this plan do not exceed the amount discussed in the data provided and accepted by BOEM.

This Section 2j was prepared by Shell pursuant to the guidance provided in the BOEM's NTL 2015-N01 with respect to blowout and worst-case discharge (WCD) scenario descriptions. Shell intends to comply with all applicable laws, regulations, rules and Notices to Lessees.

Shell focuses on an integrated, three-pronged approach to a blowout, including prevention, intervention, containment, and recovery.

1. Shell believes that the best way to manage blowouts is to prevent them from happening. Significant effort goes into design and execution of wells and into building and maintaining staff competence. Shell continues to invest independently in research and development (R&D) to improve safety and reliability of our well systems.

2. Shell is a founding member of the MWCC, which provides robust well containment (shut-in and controlled flow) capabilities. Additionally, Shell is investing in research and development (R&D) to improve containment systems.

3. As outlined in Shell's OSRP, and detailed in EP Section 9a (ii), Shell has contracts with OSROs to provide the resources necessary to respond to this WCD scenario. The capabilities for on-water recovery, aerial and subsea dispersant application, in-situ burning, and nighttime monitoring and tracking have been significantly increased.

a) Blowout scenario

The Worst Case Discharge (WCD) blowout scenario for the Alaminos Canyon Block 857 Unit (Great White Field) is calculated for the AC814 GA014 proposed development well penetration of the target Sand and based on the guidelines outlined in NTL No. 2015-N01 along with the subsequent Frequently Asked Questions (FAQ). Shell is submitting AC814 GA014 as the new worst-case scenario in the previously approved Development Operations Coordination Document (DOCD) for Great White Field. In the unlikely event of a spill, Shell's Regional OSRP (October 2017) is designed to contain and respond to a spill that meets or exceeds this WCD. This WCD does not take into account potential flow mitigating factors such as well bridging, obstructions in the wellbore, reservoir barriers, or early intervention.

b) Estimated flow rate of the potential blowout

Uncontrolled blowout (volume first day)	129,000 bbl
Uncontrolled blowout rate (first 30-days average daily rate)	78,700 bopd
Duration of flow (days) based on relief well	100 days
Total volume of spill (bbls) for 100 days	5.4 MMBO

Table 1: Worst Case Discharge Summary

C) Total volume and maximum duration of the potential blowout

Duration of flow (days)	100 days total duration to drill relief well (14 rig mob, 4 transit, 52 spud to top WM12, 30 ranging).
Total volume of spill (bbls)	5.4MMBO based on 100 days flowing. Note: From CMG IMEX dynamic reservoir models

Table 2: Estimated Duration and Volume of a Potential Blowout

There is a significant decline in the discharge rate as time proceeds, which is illustrated by the differences between the first 24-hour volume and 30-day average rate. At very short times, e.g. during the first 24 hours, the pressure profile in the reservoir changes from the moment the well first starts flowing to a pseudo-steady state pressure profile with time, and as a result the rate declines. At somewhat longer time scales, effects such as reservoir voidage and the impact of boundaries can cause the rate to drop continuously with production. Simulation and material balance models can include these effects and form the basis of the NTL No. 2010-N06 calculations for 24-hour and 30-day rates as well as maximum duration volumes.

d) Assumptions and calculations used in determining the worst case discharge (Proprietary Data)

Assumptions and calculations used in determining the worst-case discharge (WCD): See plan R-5144.

e) Potential for the well to bridge over

Mechanical failure/collapse of the borehole in a blowout scenario is influenced by several factors including in-situ stress, rock strength, and fluid velocities at the sand face. Based on the nodal analysis and reservoir simulation models outlined above, a surface blowout would create a high drawdown at the sand face. Given the substantial fluid velocities inherent in the WCD, and the scenario as defined where the formation is not supported by a cased and cemented wellbore, it is possible that the borehole may fail/collapse/bridge over within the span of a few days, significantly reducing the outflow rates. However, this WCD scenario does not assume any bridging of the wellbore.

f) Likelihood for intervention to stop the blowout.

Safety of operations is our top priority. Maintaining well control at all times to prevent a blowout is the key focus of our operations. Our safe drilling record is based on our robust standards, conservative well design, prudent operations practices, competency of personnel, and strong HSE focus. Collectively, these constitute a robust system making blowouts extremely rare events.

Intervention Devices: Notwithstanding these facts, the main scenario for recovery from a blowout event is via intervention with the BOP attached to the well. There are built in redundancies in the BOP system to allow activation of selected components with the intent to seal off the well bore. As a minimum, the Shell contracted rig fleet in the GOM will have redundancies meeting the Final Drilling Safety Rule with respect to Remotely Operated Vehicle (ROV) hot stab capabilities, a deadman system, and an autoshear system.

Containment: The experience of gaining control over the Macondo well has resulted in a better understanding of the necessary equipment and systems for well containment. As a result, industry and government are better equipped and prepared today to contain an oil well blowout in. Shell is further analyzing these advances and incorporating them into its comprehensive approach to help prevent and, if needed, control another deepwater control incident.

Shell is a founding member of the Marine Well Containment Company (MWCC), which provides robust well containment (shut-in and controlled flow) capabilities. Pursuant to NTL No. 2015-N01, Shell will provide additional information regarding our containment capabilities in a subsequent filing.

g) Availability of a rig to drill a relief well and rig package constraints

Blowout intervention can be conducted from an ROV equipped vessel, the existing drilling rig or from another drilling rig. The dynamically positioned rigs under contract below will be preferred rigs for blowout intervention work. However, moored rigs can also be used in some scenarios. Additionally, in the event of a blowout, there are other non-contracted rigs in the GOM which could be utilized for increased expediency or better suitability. All efforts will be made at the time to secure the appropriate rig. Shell's current rigs capable of operating at depths and reservoir depths without technical constraints are shown in the table below.

Rig Name	Rig Type
Noble Bully I	Dynamically Positioned Drill ship
Noble Don Taylor	Dynamically Positioned Drill ship
Noble Globetrotter I	Dynamically Positioned Drill ship
Atwood Condor	Dynamically Positioned Semisubmersible

Table 4: Available Rigs in Shell's fleet

Future modifications may change the rig's capability. Rig capabilities need to be assessed on a work scope basis.

h) Time taken to contract a rig, mobilize, and drill a relief well

Due to the location of this subsea well, drilling a relief well from a nearby platform is not an option. Relief well operations will immediately take priority and displace any activity from Shell's contracted rig fleet. The list of Shell rigs capable of operating at this location is shown in Table 4 above. It is expected to take an average of 14 days to safely secure the well that the rig is working on; up to the point the rig departs location, and a further 3-days transit to mobilize to the relief well site depending on distance to travel. The relief well will take approximately 133 days to drill down to the last casing string above the blowout zone plus approximately 35 days for precision ranging activity to intersect the blowout well bore. Total time to mobilize and drill a relief well would be approximately 185 days for this well.

Although not currently in Shell's fleet, if a moored rig is chosen to conduct the relief well operations, anchor handlers would be prioritized to prepare mooring on the relief well site while the rig is being mobilized. This activity is not expected to delay initiation of relief well drilling operations.

i) Measures proposed to enhance ability to prevent blowout and to reduce likelihood of a blowout

Shell believes that the best way to manage blowouts is to prevent them from happening. Detailed below are the measures employed by Shell with the goal of no harm to people or the environment. The Macondo incident has highlighted the importance of these practices. The lessons learned from the investigation are, and will continue to be, incorporated into our operations.

Standards: Shell's well design and operations adhere to internal corporate standards, the Code of Federal Regulations, and industry standards. A robust management of change process is in place to handle un-defined or exception situations. Ingrained in the Shell standards for well control is the philosophy of multiple barriers in the well design and operations on the well.

Risk Management: Shell believes that prevention of major incidents is best managed through the systematic identification and mitigation process (Safety Case). All Shell contracted rigs in the GoM have been operating with a Safety Case and will continue to do so. A Safety Case requires both the owner and contractors to systematically identify the risks in drilling operations and align plans to mitigate those risks; an alignment which is critical before drilling begins.

Well Design Workflow: The Well Delivery Process (WDP) is a rigorous internal assurance process with defined decision gates. The WDP leverages functional experts (internal and external) to examine the well design at the conceptual and detailed design stages for robustness before making a recommendation to the management review board. Shell's involvement in global deepwater drilling, starting in the GOM in the mid-1980's, provides a significant depth and breadth of internal drilling and operational expertise. Third party vendors and rig contractors are involved in all stages of the planning, providing their specific expertise. A Drill the Well on Paper (DWOP) exercise is conducted with rig personnel and vendors involved in execution of the well. This forum communicates the well plan, and solicits input as to the safety of the plan and procedures proposed.

Well and rig equipment qualification, certification, and quality assurance: All rigs will meet all applicable rules, regulations, and Notice to Lessees. Shell works closely with rig contractors to ensure proper upkeep of all rig equipment, which meets or exceeds the strictest of Shell, industry, or regulatory requirements. Well tangibles are governed by our internal quality assurance/control standards and industry standards.

MWD/LWD/PWD Tools: Shell intends to use MWD/LWD/PWD tools on this well, which are run on the drill string so that data on subsurface zones can be collected as the well advances in real time instead of waiting until the drill string is pulled to run wireline logs. Data from the tools are monitored and interpreted real time against prognosis to provide early warning of abnormal pressures to allow measures to be taken to progress the well safely.

Mud Logger: Mud logging personnel continually monitor returning drilling fluids for indications of hydrocarbons, utilizing both a hot wire and a gas chromatograph. An abrupt increase in gas or oil carried in the returning fluid can be an indication of an impending kick. The mud logger also monitors drill cuttings returned to the surface in the drilling fluid for changes in lithology that can be an indicator that the well has penetrated or is about to penetrate a hydrocarbon-bearing interval. Mud logging instruments also monitor penetration rate to provide an early indication of drilling breaks that show the bit penetrating a zone that could contain hydrocarbons. The mud logging personnel are in close communication with both the offshore drilling foremen and onshore Shell representative(s) to report any observed anomalies so appropriate action can be taken.

Remote Monitoring: The Real Time Operating Center has been used by Shell to complement and support traditional rig-site monitoring since 2003. Well site operations are lived virtually by onshore teams consisting of geoscientists, petrophysicist, well engineers, and 24/7 monitoring specialists. The same real time well control indicators monitored by the rig personnel are watched by the monitoring specialist for an added layer of redundancy.

Competency and Behavior: A structured training program for Well Engineers and Foreman is practiced, which includes internal professional examinations to verify competency. Other industry training in well control, such as by International Association of Drilling Contractors (IADC) and International Well Control Forum (IWCF) are also mandated. Progressions have elements of competency and Shell continues to have comprehensive internal training programs. The best systems and processes can be defeated by lack of knowledge and/or improper values. We believe that a combination of HSE tools (e.g. stop work, pre-job analysis, behavior based safety, DWOPs, audits), management HSE involvement and enforcement (e.g. compliance to life saving rules) have created a strong safety culture in our operations.

j) Measures to conduct effective and early intervention in the event of a blowout

The response to a blowout is contained in our Well Control Contingency Plan (WCCP) which is a specific requirement of our internal well control standards. The WCCP in turn is part of the wider emergency response framework within Shell that addresses the overall organization response to an emergency situation. Resources are dedicated to these systems and drills are run frequently to test preparedness (security, medical, oil spill, and hurricane). This same framework is activated and tested during hurricane evacuations, thereby maintaining a fresh and responsive team.

The WCCP specifically addresses implementing actions at the emergency site that will ensure personnel safety, organizing personnel and their roles in the response, defining information requirements, establishing protocols to mobilize specialists and pre-selecting sources, and developing mobilization plans for personnel, material and services for well control procedures. The plan references individual activity checklists, a roster of equipment and services, initial information gathering forms, a generic description of relief well drilling, strategy and guidelines, intervention techniques and equipment, site safety management, exclusion zones, and re-boarding.

Shell is currently analyzing recent advances in containment technology and equipment and will incorporate them as they become available.

k) Arrangements for drilling a relief well

The size of the Shell contracted rig fleet in the GOM from 2017-2023 ensures that there is adequate well equipment (e.g. casing and wellhead) available for relief wells. Rigs and personnel will also be readily available within Shell, diverted from their active roles elsewhere. Resources from other operators can also be leveraged should the need arise. Generally, relief well plans will mirror the blowout well, incorporating any learning on well design based on root cause analysis of the blowout. A generic relief well description is outlined in the WCCP.

l) Assumptions and calculations used in approved or proposed OSRP

Shell has designed a response program (Regional OSRP) based upon a regional capability of responding to a range of spill volumes, from small operational spills up to and including the WCD from an exploration or development well blowout. Shell's program is developed to fully satisfy federal oil spill planning regulations. The Regional OSRP presents specific information on the response program that includes a description of personnel and equipment mobilization, the incident management team organization, and the strategies and tactics used to implement effective and sustained spill containment and recovery operations.

J. <u>Chemical Products</u>

Information regarding chemical products is not included in this plan as such information is not required by BOEM GOMR.

SECTION 3 - GEOLOGICAL AND GEOPHYSICAL INFORMATION

Proprietary Data

A. Geological description

B. Structure Contour Map(s)

C. Interpreted 2D and/or 3D Seismic line(s)

D. Geological Structure Cross-section(s)

E. Shallow Hazards Report

Geoscience Earth & Marine Services, Inc. (GEMS) prepared the following reports for Shell:

Geologic and Stratigraphic Assessment Report (Project Number 0600-271) for Shell on May 21, The report covers blocks 856, 857, 900, and 901 in Alaminos Canyon of the Gulf of Mexico.

Seafloor and Near-Surface Geologic Assessment (Project No. 0204-780). The report covers Blocks 812-14, 856-858, and 900-902 in Alaminos Canyon of the Gulf of Mexico.

Integrated Study of the Great White Development Area (Project No. 0105-945-d). The report covers Blocks 813, 814, 857 and 858.

F. Shallow Hazards Assessment – See Section 6.

SECTION 4 – HYDROGEN SULFIDE

A. Concentration

None

B. Classification

Based on 30 CFR 250.490 and 30 CFR 550.215, Shell requests that the Regional Supervisor, Field Operations, determine the zones in the proposed drilling operations in this plan to be classified as an area where the absence of H2S has been confirmed.

C. H_2S Contingency Plan

Shell is not required to provide an H_2S Contingency Plan with the Application for Permit to Drill before conducting the proposed exploration activities.

D. Modeling Report

We do not anticipate encountering or handling H_2S at concentrations greater than 500 parts per million (ppm) and therefore have not included modeling for H_2S.

SECTION 5 – MINERAL RESOURCE CONSERVATION INFORMATION

A. Technology and reservoir engineering practices and procedures

Proprietary Data

B. Technology and recovery practices and procedures

Proprietary Data

C. Reservoir Development

Proprietary Data

SECTION 6: BIOLOGICAL, PHYSICAL AND SOCIOECONOMIC INFORMATION

A. Wellsite Assessment

This letter addresses specific seafloor and subsurface conditions around the proposed locations to the depth of the FR08 horizon.

Seafloor conditions appear favorable within the vicinity of the proposed surface locations. There are no potential sites for deepwater high-density benthic communities within 2,000 ft and no sonar targets of archaeological significance were identified in the vicinity of any of the proposed wellsites. There is some potential for encountering minor overpressured silts within the limit of investigation based on the stratigraphy and the drilling history in the area. There is generally a low to moderately low potential for significant shallow gas at the proposed locations based on seismic attributes and amplitude analysis.

Geohazard and Archaeological Assessments.
The following geohazard discussions are based on the findings provided within the following geohazard reports:

- Shallow Hazards Assessment, Multi-Temporal Subsidence Monitoring, & Archaeological Assessment Perdido Field Block 857 & Vicinity Alaminos Canyon Area Gulf of Mexico Report No. 2414-5056 July 2015 Fugro Geoservices Inc.

- Perdido ROV Interpretation Report 11-14-2017, Shell Proprietary Data

Available Data
This assessment is based on the analysis of: a) high-resolution geophysical datasets, b) reprocessed exploration 3D seismic data volume, c) offset well data including logs and drilling events; and d) ROV survey.

Oil Field Infrastructure and Military Warning Areas
The wellsite area is within Military Warning Area W-602. The nearest existing well, AC 857-4 (permanently abandoned), is located approximately 0.64 miles northwest of the proposed wellsite area. Pursuant to public information obtained from the BOEM database (2015a), there is no existing infrastructure within the proposed wellsite area.

<u>Proposed Wellsite GD002_and GD002_Alt, Alaminos Canyon 857 (OCS-G 17565)</u>

Proposed Well Location
The surface locations for the Proposed Development Wellsite GD002 and GD002-Alt lies near the center of AC 857. Proposed locations for wellsites GD002 and GD002-Alt are within 30 ft. of each other and will be discussed together. Table A-1 proposed locations coordinates:

Table A-1. Proposed Location Coordinates

	Proposed Wellsite GD002 and GD002-Alt			
Well Name	Spheroid & Datum: Clarke 1866 NAD27 Projection: UTM Zone 15 North		Line Reference	Block Calls (AC 857)
GD002	X: 1,022,732 ft.	Y: 9,478,189 ft.	Inline 2283 Crossline 6402	5,869' FSL/6,868' FEL
GD002 Alt	X: 1,022,711 ft.	Y: 9,478,173 ft.	Inline 2283 Crossline 6401	6,868' FSL/6,889' FEL

Our assessment addresses the seafloor conditions within a 2,000-ft radius around the proposed wellsite location. A power spectrum diagram extracted from the 3-D data around the proposed wellsite is provided as Attachment 6.1.

Wellsite Conditions
The wellsite is located along the Perdido Escarpment south of the Perdido Canyon and is characterized by complex seafloor morphology from regional tectonics. Slopes are variable and can exceed 20° along the seafloor escarpments and Perdido Canyon.

Water Depth and Seafloor Conditions.
The water depth at the proposed surface location is -8423 ft (2567.3 m) and the seafloor slopes about 9° to the east. The well site is located within a slumped area that is associated with gullies and steep-edged escarpment faces covered by sediment drape. There are several anchor drag scars in the vicinity of the proposed well sites. There is one out-of-service 6-12 Oil line within the area and is located over 1300 ft. from the proposed wellsites. There are two pressure monitor transponders within 2000 ft. of the GD002 and GD002-ALT and six transponder frames located approximately 1300 ft. from proposed well sites.

Deepwater Benthic Communities. Deepwater high density benthic communities are not expected at the proposed wellsite. There are no features or areas that could or have been observed to support significant, high-density, benthic communities within 2,000 ft of the proposed location. There are no water bottom anomalies (positive possible oil) as defined by BOEM (BOEM, 2017) within 2,000 ft. of the proposed location. The high-resolution data: The Amplitude-Enhanced Surface Rendering, the Side-Scan Sonar Mosaic, the Multibeam Backscatter Mosaic and Sub Bottom Profiler data indicated an area of possible seafloor expulsion to the northwest of the GD002 and GD002-Alt locations. Visual images of the seafloor from a ROV survey over this area indicate it does not support high-density benthic communities. See attachment 6.9 ROV report and 6.8 Seafloor backscatter diagram with features.

Stratigraphy. Stratigraphic conditions from the seabed to the FR08 Horizon are shown on the Tophole Prognosis Chart (Illustration GD002 6). The FR08 is estimated to be 1,424 ft BML or -9,847 ft below sea level (BSL). The stratigraphy, as defined by the 3-D seismic data, has been divided into 6 Units across the Perdido Field. Because of faults deeper in the section along the GD002 wellbore, Units 4-6 have been lumped together in this prognosis.

Near-Surface Sediments.
The near-surface sediments consist of a drape (0-35 ft BML), MTD (35-48 ft BML), interbedded thin MTDs and drape (48-105 ft BML), and additional MTDs below 105 ft BML. Over-compacted MTDs within the jetting interval may result in slow rates of penetration.

Unit 1 (Seafloor to Event A). Unit 1 beneath the proposed GD002 is 243 ft thick (Attachment 6.3). The unit consists of predominantly muds with occasional possible silts.

Unit 2 (Event A to Event B). Unit 2 beneath the proposed GD002 is 194 ft thick (Attachment 6.3). The unit consists of predominantly muds with occasional possible silts. Brighter amplitudes in within the Unit are interpreted to be silts and have been verified by offset well data.

Unit 3 (Event B to Event C). Unit 3 beneath the proposed GD002 is 440 ft thick ((Attachment 6.3). The unit consists of predominantly muds and silts.

Units 4-6 (Event C to FRO8 Top). Units 4-6 beneath the proposed GD002 is 547 ft thick ((Attachment 6.3). The unit consists of predominantly muds with occasional marls, thin carbonate beds, and possible thin sands near the base. This unit may contain minor residual oil and drilled gas.

Faults. A wellbore beneath the proposed Wellsite GD002 location will intersect mapped fault planes at 1027 ft BML and at 1277 ft BML. These faults are part of the complex listric extensional faulting that extends along the main escarpment from seafloor to the FR08 event. Its seafloor expression is over 1000 feet west from proposed surface location. The wellbore may also encounter subseismic faults within Units 3-6.

Shallow Gas and Shallow Water Flow. Significant shallow gas is not expected at this proposed wellsite (Attachment 6.6). The potential for shallow water flow at this well location is moderately low.

Shallow Gas. There are no apparent subsurface high-amplitude anomalies directly below the proposed wellsite. The potential for encountering significant amounts of gas within silt-lenses is generally considered moderately low. Minor residual oil and drilled gas may be encountered within Units 4-6.

Shallow Water Flow. The potential for shallow water flow at this well location from the seafloor to 1,424 ft BML is low to moderately low (Attachment 6.6). Silt-lenses with some potential for overpressures occur from seafloor to the FR08 horizon.

Archaeological Assessment
The archaeological assessments of side-scan sonar covering AC 857 and the surrounding area resulted in seven sonar contacts being identified within 2000 ft. of the Proposed wellsites GD002 and GD002-Alt. The sonar contacts identified are interpreted to be modern debris or are natural in origin. None of the sonar contacts are interpreted to be of archaeological significance within 2000 ft. of proposed wellsites GD002 and GD002-Alt.

Proposed Wellsite GD002 and GD002-Alt, Concluding Remarks

The Proposed Wellsite GD002 and GD002-Alt, Alaminos Canyon 857 (OCS-G-17565), appears suitable for developmental drilling operations. No seafloor obstructions or conditions exist that will be a constraint to equipment at the proposed location. Engineers should be aware of the potential for slightly over pressured silt lenses, hydrates, fault crossings, and possible over consolidated sediments near surface.

The Great White area lies approximately 206 nautical miles south of Galveston Island, Texas, in the south-central portion of the Alaminos Canyon. Block 857 is near the base of the continental slope, west-southwest of the Alaminos Canyon feature. The Perdido Canyon is an approximately west-east oriented incised canyon, which lies to the north of AC 857, encroaching on the extreme northern boundary of the block only. The Great White area is near the northernmost extension of the Perdido Escarpment. The Sigsbee and Perdido escarpments are the sea-bottom topographic expressions of the lobate frontal edge of a complex system of salt ridges, over-thrust tongues, and steep-sided massifs. These escarpments mark the foot of the Texas/Louisiana continental slope (Martin and Bouma, 1978).

The principal topographic feature of Block AC 857 is a topographic high and associated escarpment, which plunges from southwest to northeast where it encounters the Perdido Canyon. This ridge represents the seabed expression of Perdido folding. Extension across this ridge has resulted in complex faulting and rotational sliding in the shallow section. Principal fault strike is similarly along a southwest-northeast orientation.

Existing Shell wells AC 857 #1 and AC 857 #2 are located 6370 ft southwest of the GD002 location. The Shell AC 857 #4 well is located 4310 ft northwest of GD002. These existing wells are located in an area with seabed topography and shallow stratigraphy similar to the proposed Southwest Cluster wells. Total drilled a well in the AC 856 block, AC 856 #1, that is located approximately 10,475 ft southwest of GD002. There were no shallow drilling problems encountered in any of the above wells.

B. Topographic Features Map

The proposed activities are not within 1,000' of a no-activity zone or within the 3-mile radius zone of an identified topographic feature. Therefore, no map is required per NTL No. 2008-G04.

C. Topographic Features Statement (Shunting)

Shell does not plan to drill more than two wells from the same surface location within the Protective Zone of an identified topographic feature. Therefore, the topographic features statement required by NTL No. 2008-G04 is not applicable.

D. Live Bottoms (Pinnacle Trend) Map

The activities proposed in this plan are not within 200' of any pinnacle trend feature with vertical relief equal to or greater than 8'. Therefore, no map is required per NTL No. 2008-G04.

E. Live Bottoms (Low Relief) Map

The activities proposed in this plan are not within 100' of any live bottom low relief features. Therefore, no map is required per NTL No. 2008-G04.

F. Potentially Sensitive Biological Features

The activities proposed in this plan are not within 200' of any potentially sensitive biological features. Therefore, no map is required per NTL No. 2008-G04.

G. Remotely Operated Vehicle (ROV) Monitoring Plan

This information is no longer required by BOEM GoM.

H. Threatened and Endangered Species Information

Under Section 7 of the Endangered Species Act (ESA) all federal agencies must ensure that any actions they authorize, fund, or carry out are not likely to jeopardize the continued existence of a listed species, or destroy or adversely modify its designated critical habitat.

In accordance with the 30 CFR 250, Subpart B, effective May 14, 2007 and further outlined in Notice to Lessees (NTL) 2008-G04, lessees/operators are required to address site-specific information on the presence of federally listed threatened or endangered species and critical habitat designated under the ESA and marine mammals protected under the Marine Mammal Protection Act (MMPA) in the area of proposes activities under this plan.

Currently there are no designated critical habitats for the listed species in the Gulf of Mexico Outer Continental Shelf; however, it is possible that one or more of these species could be seen in the area of our operations. The following table reflects the Federally-listed endangered and threatened species in the lease area and along the northern Gulf coast:

Common Name	Scientific Name	T/E Status
Hawksbill Turtle	*Eretmochelys imbricata*	E
Green Turtle	*Chelonia mydas*	T/E
Kemp's Ridley Turtle	*Lepidochelys kempii*	E
Leatherback Turtle	*Dermochelys coriacea*	E
Loggerhead Turtle	*Caretta caretta*	T

Table 6.6 – Threatened and Endangered Sea Turtles

The green sea turtle is threatened, except for the Florida breeding population, which is listed as endangered.

There are 29 species of marine mammals that may be found in the Gulf of Mexico (see Table 6.7 below). Of the species listed as Endangered, only the Sperm whale is commonly found in the project area. No critical habitat for these species has been designated in the Gulf of Mexico.

Common Name	Scientific Name	T/E Status
Atlantic Spotted Dolphin	*Stenella frontalis*	
Blainville's Beaked Whale	*Mesoplodon densirostris*	
Blue Whale	*Balaenoptera musculus*	E
Bottlenose Dolphin	*Tursiops truncatus*	
Bryde's Whale	*Balaenoptera edeni*	
Clymene Dolphin	*Stenella clymene*	
Cuvier's Beaked Whale	*Ziphius cavirostris*	
Dwarf Sperm Whale	*Kogia simus*	
False Killer Whale	*Pseudorca crassidens*	
Fin Whale	*Balaenoptera physalus*	E
Fraser's Dolphin	*Lagenodelphis hosei*	
Gervais' Beaked Whale	*Mesoplodon europaeus*	
Humpback Whale	*Megaptera novaeangliae*	E
Killer Whale	*Orcinus orca*	

Melon-headed Whale	*Peponocephala electra*	
Minke Whale	*Balaenoptera acutorostrata*	
North Atlantic Right Whale	*Eubalaena glacialis*	E
Pantropical Spotted Dolphin	*Stenella attenuata*	
Pygmy Killer Whale	*Feresa attenuata*	
Pygmy Sperm Whale	*Kogia breviceps*	
Risso's Dolphin	*Grampus griseus*	
Rough-toothed Dolphin	*Steno bredanensis*	
Sei Whale	*Balaenoptera borealis*	E
Short-finned Pilot Whale	*Globicephala macrorhynchus*	
Sowerby's Beaked Whale	*Mesoplodon bidens*	
Sperm Whale	*Physeter macrocephalus*	E
Spinner Dolphin (Long-snouted)	*Stenella longirostris*	
Striped Dolphin	*Stenella coeruleoalba*	
Florida manatee	*Trichechus manatus*	E

Table 6.7 – Threatened and Endangered Marine Mammals

The blue, fin, humpback, North Atlantic right and sei whales are rare or extralimital in the Gulf of Mexico and are unlikely to be present in the lease area. The Environmental Impact Analysis found in Section 18 discusses potential impacts and mitigation measures related to threatened and endangered species.

I. Archaeological Report

AC 857 has not been identified as having a high probability of archeological features.

J. Air and Water Quality Information

Drilling/completion operations will produce air pollutant emissions, but as provided in the Air Emissions Spreadsheet (see Section 8 of this Plan), these operations are below the exemption levels.

These drilling operations will result in the discharge of authorized effluents under the EPA Region VI General permit. Impacts of these discharges are expected to be minimal on water quality in the area.

For specific information relating to air and water quality information please refer to Section 18 in previous plans.

K. Socioeconomic Information

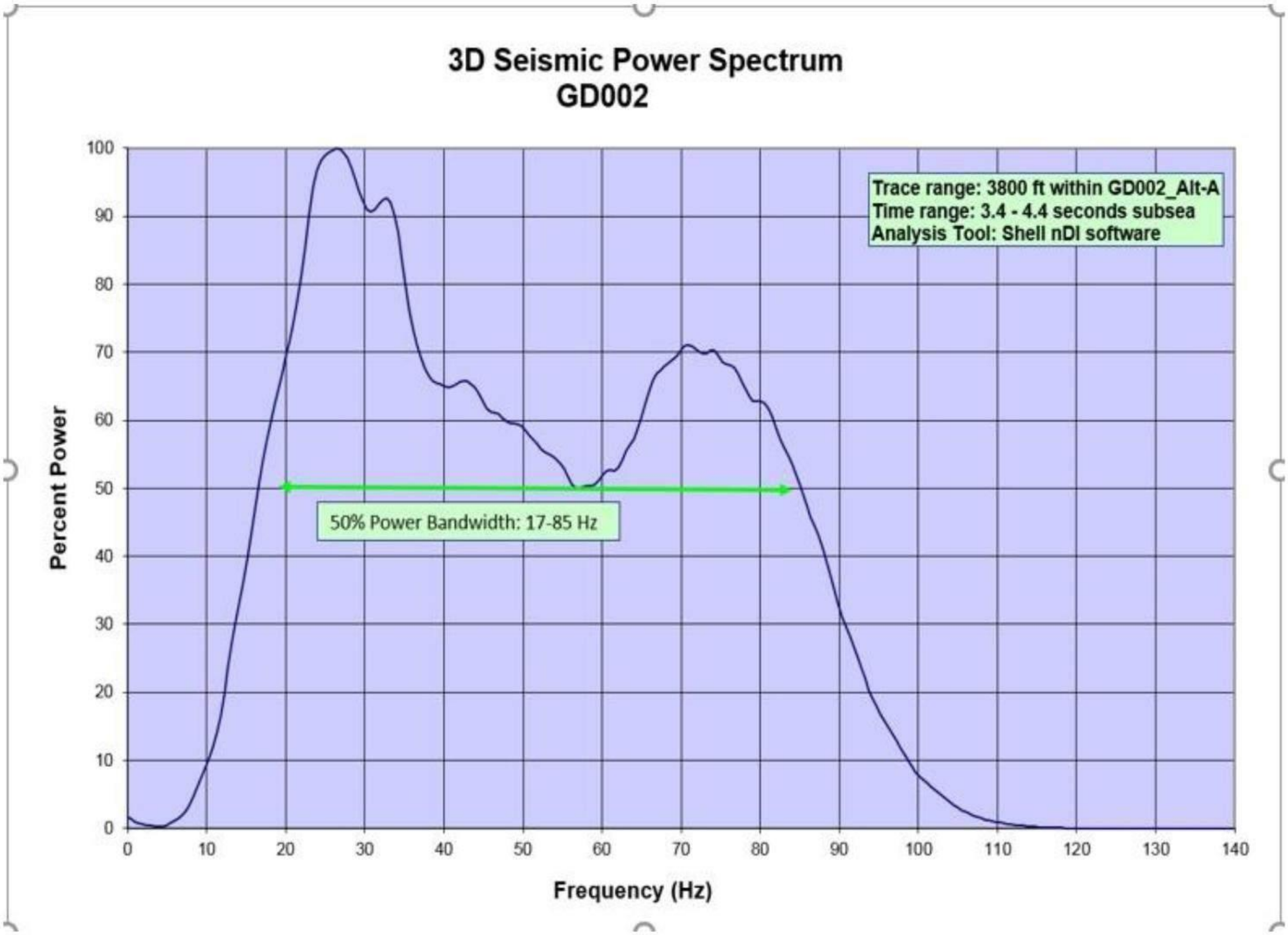
1) Shell will utilize its existing shorebase located in Fourchon, Louisiana which is fully staffed and operational and does not expect to employ persons from within the State of Florida.

2) Shell does not expect to purchase major supplies, services, energy, water or other resources from within the State of Florida for these operations.

3) Shell does not expect to hire contractors or vendors from within the State of Florida.

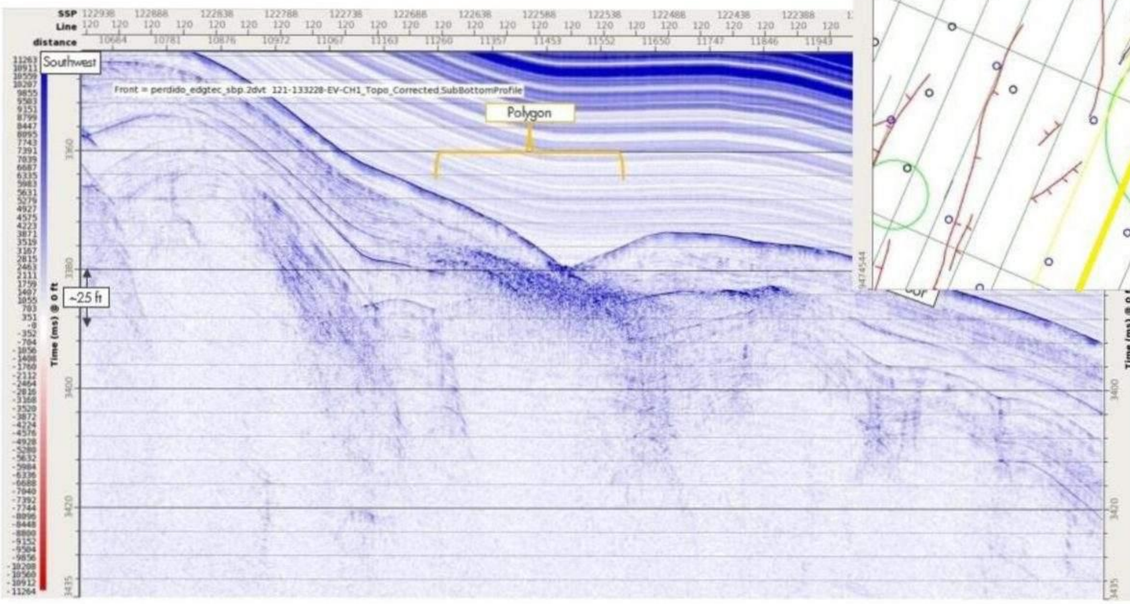
For specific information relating to socioeconomic information please refer to Section 18 in this Plan.

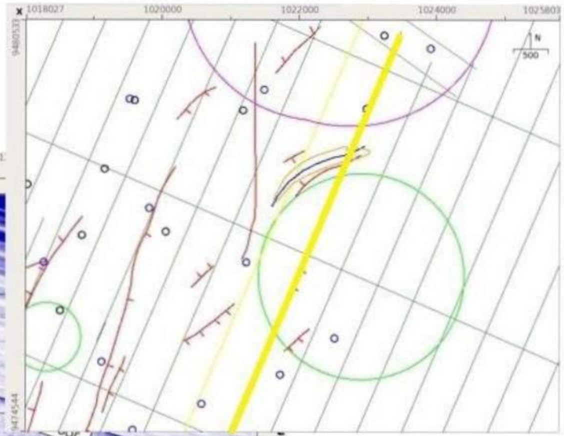
Attachment 6.1



Attachment 6.2

Subbottom Profiler Line 120





Attachment 6.3

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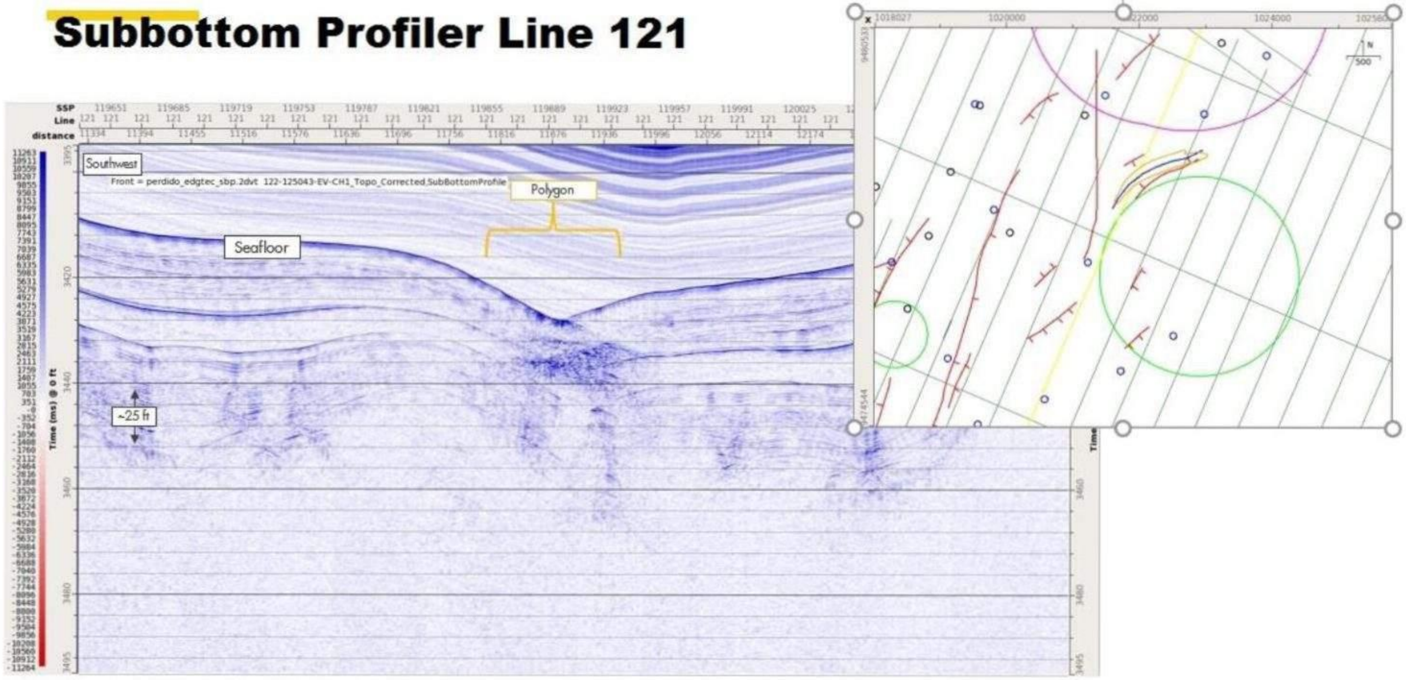

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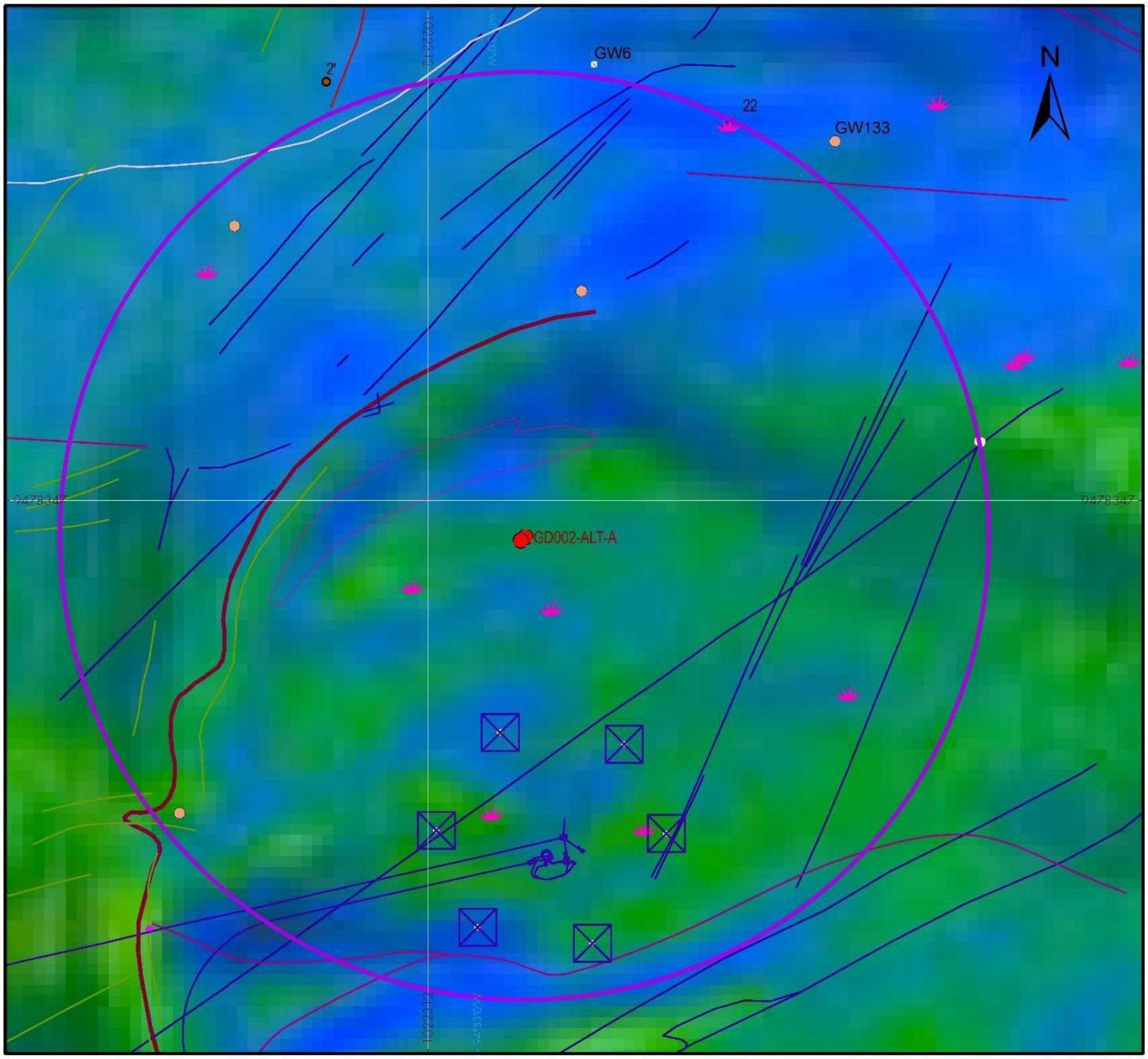
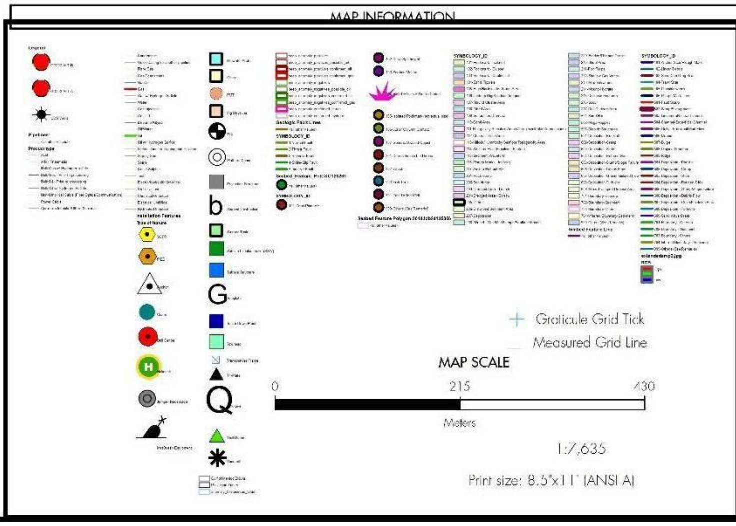


MAP INFORMATION



SHELL EXPLORATION & PRODUCTION COMPANY

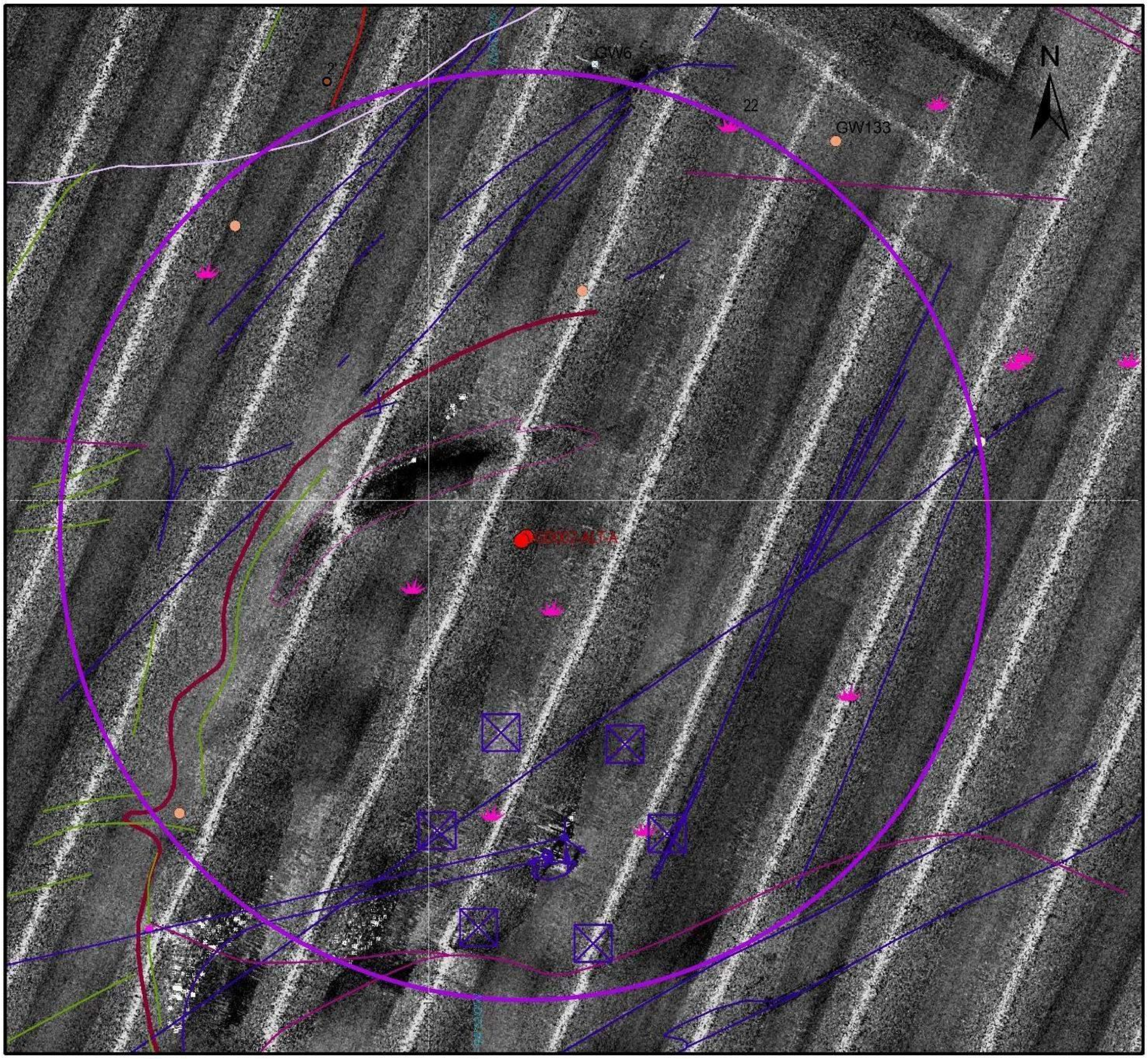
Seafloor Amplitude Rendering w/ Features GD002 and GD002-ALT

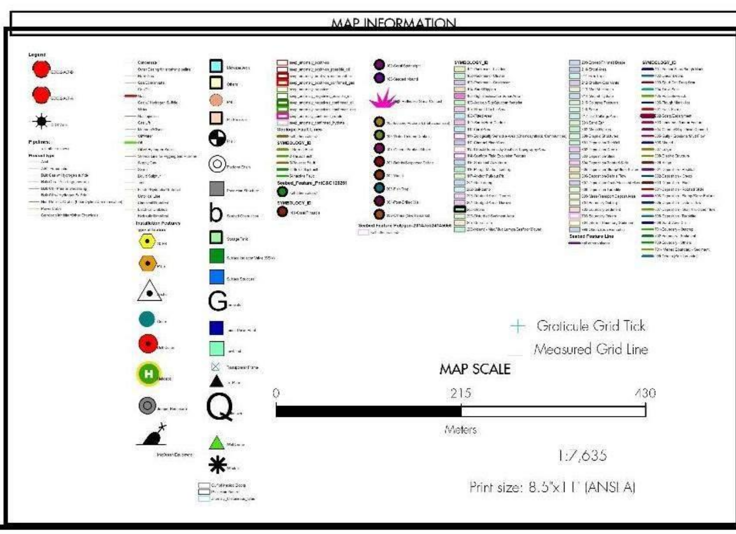
GEODETIC PARAMETERS

Horizontal Coordinate Reference System
CRS name (ESRI): NAD 1927 BLM Zone 15N
CRS name (Shell): [CLICK TO UPDATE]
CRS code (EPSG): [CLICK TO UPDATE]
Geodetic datum: North American 1927
Projection name: Transverse Mercator
Horizontal units: Foot US
Vertical Coordinate Reference System
Vertical datum: [CLICK TO UPDATE]
Elevation/Depth: [CLICK TO UPDATE]
Vertical units: [CLICK TO UPDATE]

Author: Update Document Properties | Date: 03 Jan 2018
Name: wellsitemapv2
EP Catalog No.: N/A
RESTRICTED

Attachment 6.5





SHELL EXPLORATION & PRODUCTION COMPANY

Seafloor Backscatter w/ Features
GD002 and GD002-ALT

GEODETIC PARAMETERS

Horizontal Coordinate Reference System
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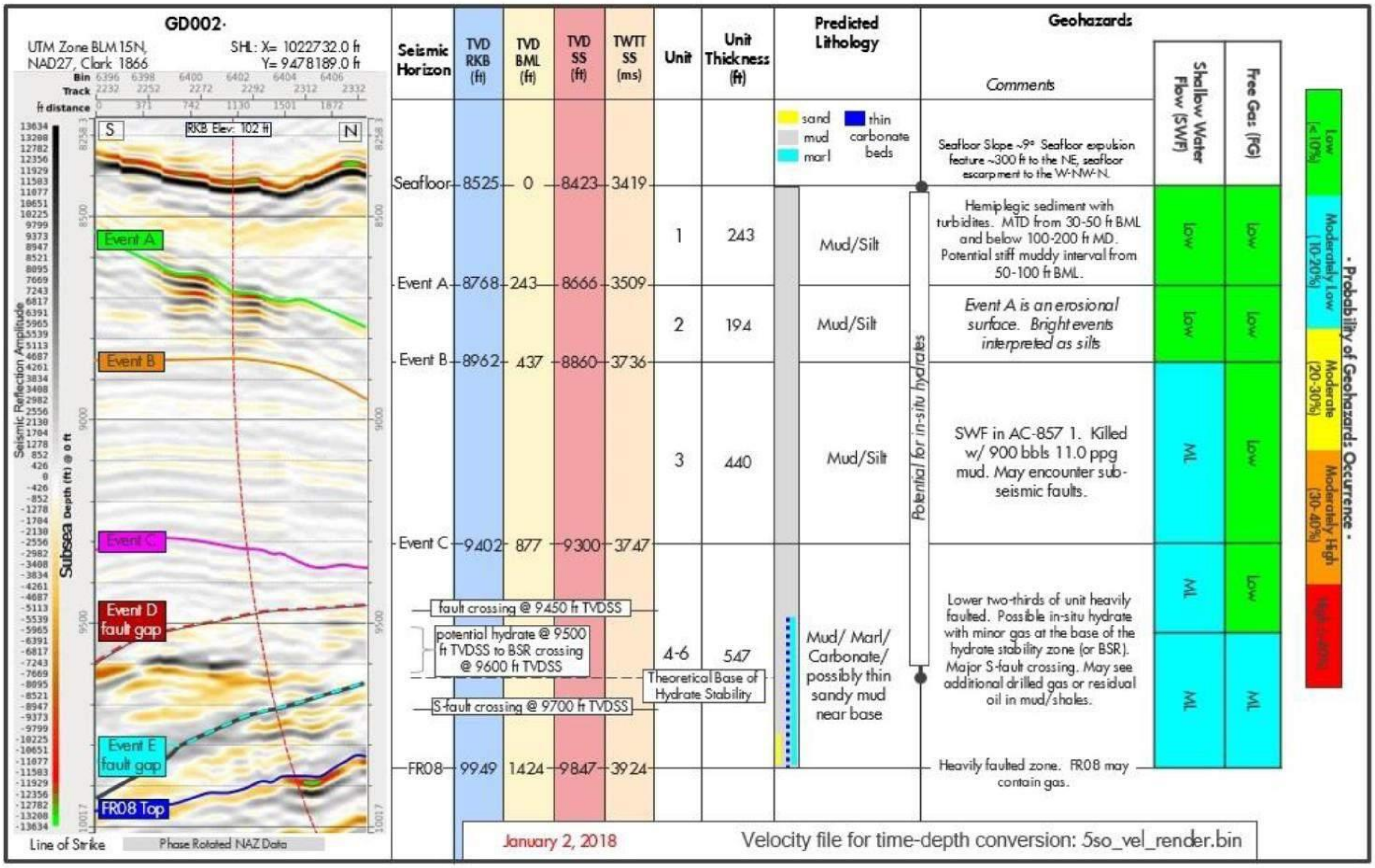
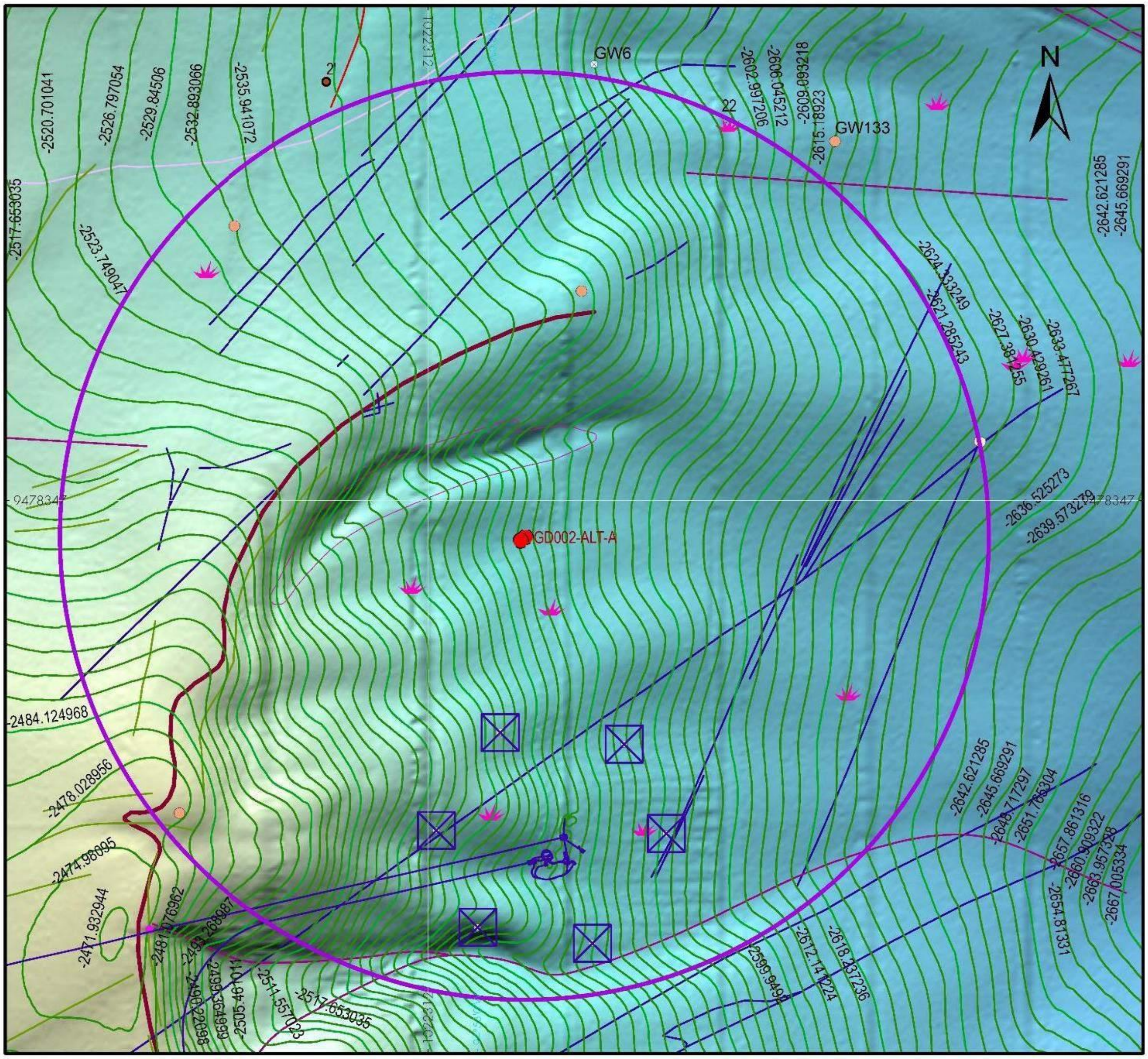
CRS name (Shell): [CLICK TO UPDATE]
CRS code (EPSG): [CLICK TO UPDATE]
Geodetic datum: North American 1927
Projection name: Transverse Mercator
Horizontal units: Foot US
Vertical Coordinate Reference System
Vertical datum: [CLICK TO UPDATE]
Elevation/Depth: [CLICK TO UPDATE]
Vertical units: [CLICK TO UPDATE]

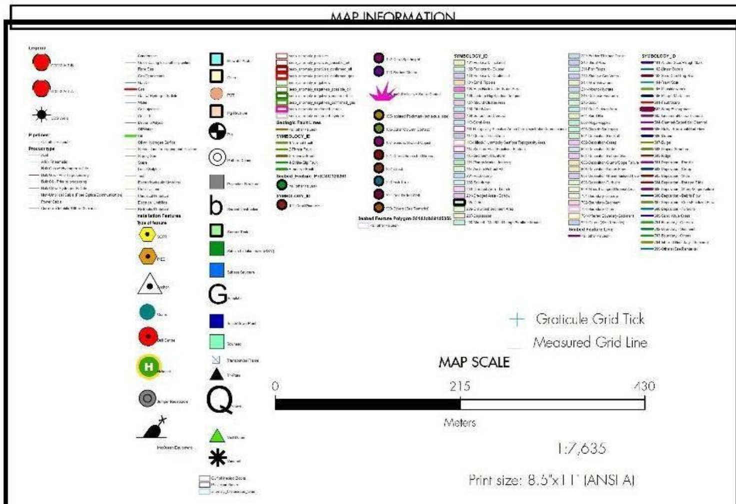
Author: Update Document Properties	Date: 03 Jan 2018
Name: wellsitemapv2	
EP Catalog No.: N/A	RESTRICTED

Attachment 6.6





MAP INFORMATION



1:7,635

Print size: 8.5"x11" (ANSI A)

SHELL EXPLORATION & PRODUCTION COMPANY

Seafloor Multibeam Rendering w/ Features
GD002 and GD002-ALT

GEODETIC PARAMETERS

Horizontal Coordinate Reference System
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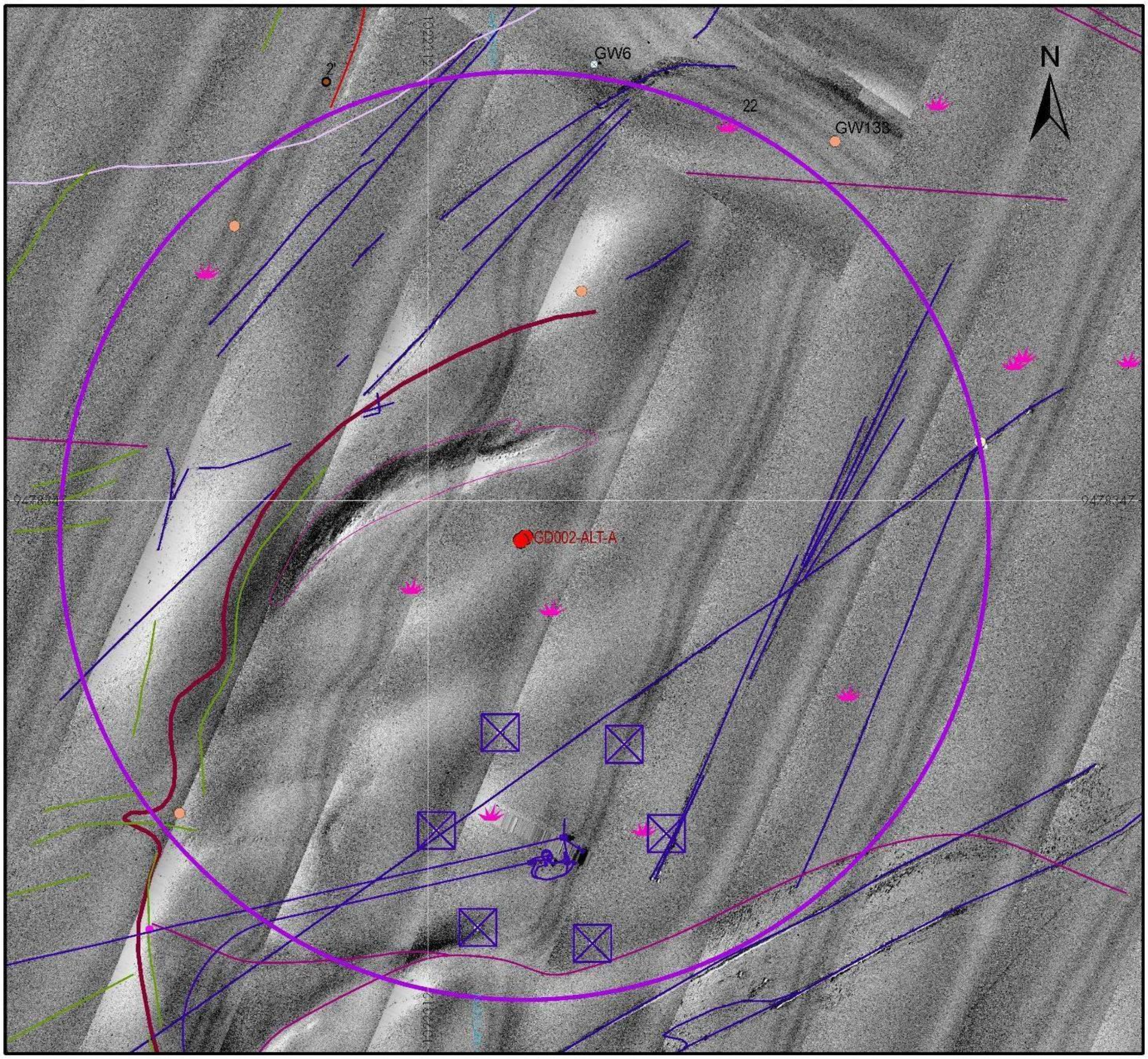
CRS name (Shell): [CLICK TO UPDATE]
CRS code (EPSG): [CLICK TO UPDATE]
Geodetic datum: North American 1927
Projection name: Transverse Mercator
Horizontal units: Foot US
Vertical Coordinate Reference System
Vertical datum: [CLICK TO UPDATE]
Elevation/Depth: [CLICK TO UPDATE]
Vertical units: [CLICK TO UPDATE]

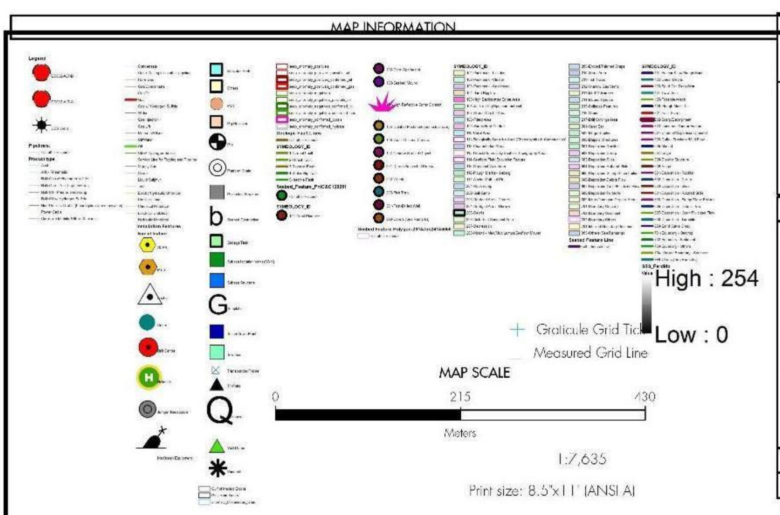
Author: Update Document Properties	Date: 03 Jan 2018

Name: wellsitemapv2

EP Catalog No.: N/A RESTRICTED

Attachment 6.8





SHELL EXPLORATION & PRODUCTION COMPANY

Seafloor Side Scan Sonar w/ Features GD002- and GD002-ALT

GEODETIC PARAMETERS

Horizontal Coordinate Reference System
CRS name (ESRI): NAD 1927 BLM Zone 15N
CRS name (Shell): [CLICK TO UPDATE]
CRS code (EPSG): [CLICK TO UPDATE]
Geodetic datum: North American 1927
Projection name: Transverse Mercator
Horizontal units: Foot US

Vertical Coordinate Reference System
Vertical datum: [CLICK TO UPDATE]
Elevation/Depth: [CLICK TO UPDATE]
Vertical units: [CLICK TO UPDATE]

Author: Update Document Properties | Date: 03 Jan 2018
Name: wellsitemapv2
EP Catalog No.: N/A
RESTRICTED

Attachment 6.9

Perdido ROV Interpretation (Proprietary data)

TABLE 7A: WASTES YOU WILL GENERATE, TREAT AND DOWNHOLE DISPOSE OR DISCHARGE TO THE GOM

Note: Please specify if the amount reported is a total or per well amount

Projected generated waste			Projected ocean discharges		Projected Downhole Disposal
Type of Waste and Composition	**Composition**	**Projected Amount Total by well**	**Discharge rate/day/per well**	**Discharge Method**	**Answer yes or no**
Will drilling occur ? If yes, you should list muds and cuttings					
EXAMPLE: Cuttings wetted with ynthetic based fluid	*Cuttings generated while using synthetic based drilling fluid.*	*X bbl/well*	*X bbl/day*	*discharge pipe*	*No*
Water-based drilling fluid	barite, additives, mud	3,784,300 bbls	26,650 bbls/day	Seafloor discharge prior to marine riser installation	No
Cuttings wetted with water-based fluid	Cuttings coated with water based drilling mud	75,260 bbls	530 bbls/day	Seafloor discharge prior to marine riser installation	No
Cuttings wetted with synthetic-based fluid	Cuttings generated while using synthetic based drilling fluid	35,500 bbls	250 bbls/day	Cuttings chute below MSL	No
Synthetic based drilling fluid adhering to washed drill cuttings	Synthetic based drilling fluid adhering to washed drill cuttings	1,420 bbls	10 bbls/day	Cuttings chute below MSL	No
Will humans be there? If yes, expect conventional waste					
EXAMPLE: Sanitary waste water		*X liter/person/day*	*NA*	*chlorinate and discharge*	*No*
Domestic waste (kitchen water, shower water)	grey water	30,530 bbls/well	215 bbls/day	Ground to less than 25 mm mesh size and discharge overboard	No
Sanitary waste (toilet water)	treated sanitary waste	10,224 bbls/well	72 bbls/day	Treated in the MSD** prior to discharge to meet NPDES limits	No
Is there a deck? If yes, there will be Deck Drainage					
Deck Drainage	Wash and rainwater	1,420 bbls/well	10 bbls/day	Drained overboard through deck scuppers	No
Will you conduct well treatment, completion, or workover?					
Well Treatment Fluids	Water based frac fluids. Solvent based pipe pickle	50 bbls/well	>50 bbls/well	completion and will be flowed back to the host facility when the well is brought online. Returns will be minimal and will undergo static sheen testing and monthly grease compliance testing prior to discharge overboard. Pipe pickle to be collected and disposed of onshore.	No
Well Completion Fuids	NaCl	1,500 bbls/well	>1,500 bbls/well	Returns will undergo static sheen testing and monthly grease compliance testing prior to discharge overboard.	No
Well Clean Up Fluids	Viscous Spacer NaCl brine (riser clean out)	3,000 bbls/well	3,000 bbls/well	Viscous spacer and NaCl will undergo static sheen testing and monthly grease compliance and be discharged overboard.	No
Miscellaneous discharges. If yes, only fill in those associated with your activity.					
Desalinization unit discharge	Rejected water from watermaker unit	1,420 bbls/well	10 bbls/day	Discharged overboard 35 feet below waterline	No
Blowout prevent fluid	Water based	85.2 bbls/well	0.6 bbls/day	Disharge at seafloor	No
Ballast water	Uncontaminated seawater	312,400 bbls/well	2,200 bbls/day	Discharged overboard just above waterline	No
Bilge water	Bilge and drainage water will be treated to MARPOL standards (< 15ppm oil in water).	26,270 bbls/well	185 bbls/day	Bilge and drainage water will be treated to MARPOL standards (< 15ppm oil in water).	No
Excess cement at seafloor	Cement slurry	450 bbls/well (assume planned 100% excess is discharged)	450 bbls/well	Discharged at the seafloor during riserless drilling	No
Fire water	Treated seawater	9,460 bbls/well	2,000 bbls/month	Drained overboard through deck scuppers	No
Cooling water	Treated seawater	61,288,620 bbls/well	431,610 bbls/day	Discharged overboard 40 feet below waterline	No
Will you produce hydrocarbons? If yes fill in for produced water.					
Produced water	Produced water	500 bbls/day/well	50 bbls/day	Overboard through approved dischartge site.	NA
Will you be covered by an individual or general NPDES permit ?		Yes	**GENERAL PERMIT**	GMG290103	

TABLE 7B: WASTES YOU WILL TRANSPORT AND /OR DISPOSE OF ONSHORE

Note: Please specify whether the amount reported is a total or per well

Projected generated waste		Solid and Liquid Wastes transportation	Waste Disposal		
Type of Waste	**Composition**	**Transport Method**	**Name/Location of Facility**	**Amount**	**Disposal Method**
Will drilling occur ? If yes, fill in the muds and cuttings.					
EXAMPLE: Oil-based drilling fluid or mud	NA	NA	NA	NA	NA
Synthetic-based drilling fluid or mud	Used SBF and additives	Drums or dedicated tanks on support vessels	MI Drilling Fluids - Fourchon, LA	7,000 bbls/well	Recycled
Cuttings wetted with Synthetic-based fluid	Drill cuttings from synthetic based interval.	Storage tank on supply boat	Lamp Environmental, Hammond, LA	150 bbls / well	Recycled
Will you produce hydrocarbons? If yes fill in for produced sand.					
Produced sand	NA- this well has sand control	NA	NA	NA	NA
Will you have additional wastes that are not permitted for discharge? If yes, fill in the appropriate rows.					
EXAMPLE: trash and debris	***cardboard, aluminum,***	***barged in a storage bin***	***shorebase***	***z tons total***	***recycle***
Trash and debris - recyclables	trash and debris	Storage bins on supply boat	Omega Waste Management, W. Patterson, LA or ARC, New Iberia, LA	22,400 lbs/well	Recylced
Trash and debris - non-recyclables	trash and debris	Storage bins on supply boat	Republic/BFI landfill, Sorrento, LA or the parish landfill, Avondale, LA	11,200 lbs/well	Landfill
used oil	used oil	Drums on supply boat	Omega Waste Management, W. Patterson, LA or ARC, New Iberia, LA	55 bbls/well	Incinerate
Chemical product wastes	Solvent	Captured at surface in MPT tanks, transported onshore for disposal in an environmentally friendly manner.	Lamp Environmental, Hammond, LA	150 bbls/well	Recycled
NOTE: If you will not have a type of waste, enter NA in the row.					

SECTION 8 - AIR EMISSIONS INFORMATION

A. Emissions Worksheet and Screening Questions

Screening Questions for DOCD's	Yes	No
Is any calculated Complex Total (CT) Emission amount (in tons) associated with your proposed exploration activities more than 90% of the amounts calculated using the following formulas: $CT = 3400D^{2/3}$ for CO, and $CT = 33.3D$ for the other air pollutants (where D = distance to shore in miles)?	X	
Do your emission calculations include any emission reduction measures or modified emission factors?		X
Does or will the facility complex associated with your proposed development and production activities process production from eight or more wells?	X	
Do you expect to encounter H_2S at concentrations greater than 20 parts per million (ppm)?		X
Do you propose to flare or vent natural gas in excess of the criteria set forth under 250.1105(a)(2) and (3)?		X
Do you propose to burn produced hydrocarbon liquids?		X
Are your proposed development and production activities located within 25 miles from shore?		X
Are your proposed development and production activities located within 200 kilometers of the Breton Wilderness Area?		X

B. If you answer *no* to all of the above screening questions from the appropriate table, provide:

1) Summary information regarding the peak year emissions for both Plan Emissions and Complex Total Emissions, if applicable. This information is compiled on the summary form of the two sets of worksheets. You can submit either these summary forms or use the format below. You do not need to include the entire set of worksheets.

Air Pollutant		Plan Emission[1] Amounts (tons)	Calculated Exemption[2] Amounts (tons)		Calculated Complex Total Emission Amounts[3] (tons)
PM					
SO_x					
NOx					
VOC					
CO					

2) Contact: Tracy Albert, 504.425.4652, tracy.albert@shell.com

C. Worksheets

Worksheets are attached.

Note: The activities proposed in this plan will not increase or change the air emissions for the Perdido Host platform, approved under plan R-6489.

*The days for future well work will not exceed the 200 days per year as listed above.
**The schedule and AQR for 2018 includes the activities for the GD003 (or GD003-Alt if well is lost) well from Plan R-6665.
***The schedule and AQR for 2019 includes the activities for the GD004 well from Plan R-6665.
Note: The GB wells in Plan R-5144/R6297 will not be drilled in 2018-2019.

COMPANY	Shell Offshore Inc
AREA	Alaminos Canyon
BLOCK	857
LEASE	OCS-G 17565
PLATFORM	DP MODU, DP Semi
WELL	GD002/002Alt drilling and well work (incl. workover and maintenance)
DISTANCE TO LAND	142
COMPANY CONTACT	Joshua O'Brien
TELEPHONE NO.	504-425-9097
REMARKS	Great White Frio, GD02-DOCD AQR-MODU INST-20180111-FINAL.xlsx Drill and complete GD002 & GD002-ALT, and install flowlines/jumpers.

LEASE TERM PIPELINE CONSTRUCTION INFORMATION:		
YEAR	NUMBER OF PIPELINES	TOTAL NUMBER OF CONSTRUCTION DAYS
2018	1	18
2019	1	18
2020		
2021		
2022		
2023		
2024		
2025		
2026		
2027		
2028		
2029		
2030		

Drilling and future well work for GD002 and GD002-Alt. Also including jumper installation.

AIR EMISSIONS CALCULATIONS - 2018-2030

COMPANY	AREA	BLOCK	LEASE	PLATFORM	WELL	CONTACT	PHONE	REMARKS
Shell Offshore Inc	Alaminos Canyon	857	OCS-G 17565		GD wells and well work (incl. wo	Joshua O'Brien	504-425-909	Great White Frio,GD02-DOCD AQR-MODU INST-20180111-FINAL.xlsx Drill and complete GD002 & GD002-ALT, and install flowlines/jumpers.

OPERATIONS	EQUIPMENT	RATING	AX. FUE	ACT. FUEL	RUN TIME		MAXIMUM POUNDS PER HOUR					ESTIMATED TONS				
	Diesel Engines	HP	GAL/HR	GAL/D												
	Nat. Gas Engines	HP	SCF/HR	SCF/D												
	Burners	MMBTU/HF	SCF/HR	SCF/D	HR/D	DAYS	PM	SOx	NOx	VOC	CO	PM	SOx	NOx	VOC	CO
DP	PRIME MOVER>600hp diesel	10728	518	12436	24	200	7.56	4.34	259.93	7.80	56.71	18.15	10.41	623.83	18.71	136.11
Drilling/Well Work	PRIME MOVER>600hp diesel	10728	518	12436	24	200	7.56	4.34	259.93	7.80	56.71	18.15	10.41	623.83	18.71	136.11
	PRIME MOVER>600hp diesel	10728	518	12436	24	200	7.56	4.34	259.93	7.80	56.71	18.15	10.41	623.83	18.71	136.11
	PRIME MOVER>600hp diesel	10728	518	12436	24	200	7.56	4.34	259.93	7.80	56.71	18.15	10.41	623.83	18.71	136.11
	PRIME MOVER>600hp diesel	10728	518	12436	24	200	7.56	4.34	259.93	7.80	56.71	18.15	10.41	623.83	18.71	136.11
	PRIME MOVER>600hp diesel	10728	518	12436	24	200	7.56	4.34	259.93	7.80	56.71	18.15	10.41	623.83	18.71	136.11
	Energency Generator>600hp diese	2547	123	2952	1	200	1.80	1.03	61.71	1.85	13.46	0.18	0.10	6.17	0.19	1.35
	Emergency Air Compressor< 600h	26	1	30	1	200	0.06	0.01	0.80	0.06	0.17	0.01	0.00	0.08	0.01	0.02
	All other rig-equipment is electric (e.g cranes) or negligible in emissions potential (e.g. life boats, welding equipment, etc.)															
	Supply Vessel>600hp diesel (gene	10100	488	11708	24	200	7.12	4.08	244.71	7.34	53.39	17.09	9.80	587.31	17.62	128.14
	Supply Vessel>600hp diesel (riserl	10100	488	11708	24	10	7.12	4.08	244.71	7.34	53.39	0.85	0.49	29.37	0.88	6.41
	Supply Vessel>600hp diesel (riserl	10100	488	11708	24	10	7.12	4.08	244.71	7.34	53.39	0.85	0.49	29.37	0.88	6.41
	Crew Vessel>600hp diesel	8000	386	9274	24	60	5.64	3.23	193.83	5.81	42.29	4.06	2.33	139.56	4.19	30.45
PIPELINE	INSTALLATION Vessel diesel	21389	1033.1	24794.07	24	18	15.08	8.65	518.23	15.55	113.07	3.26	1.87	111.94	3.36	24.42
INSTALLATION	VESSELS>600hp diesel(supply)	10100	487.83	11707.92	24	18	7.12	4.08	244.71	7.34	53.39	1.54	0.88	52.86	1.59	11.53
	INSTALLATION/SUPPORT VESSE	14751	712.47	17099.36	24	5	10.40	5.96	357.40	10.72	77.98	0.62	0.36	21.44	0.64	4.68
	VESSELS>600hp diesel(crew)	8000	386.4	9273.60	24	3	5.64	3.23	193.83	5.81	42.29	0.20	0.12	6.98	0.21	1.52
	2018-2030 TOTAL						**112.45**	**64.46**	**3864.25**	**115.97**	**843.11**	**137.55**	**78.87**	**4728.06**	**141.85**	**1031.58**
EXEMPTION CALCULATION	**DISTANCE FROM LAND IN MILES**											**4728.60**	**4728.60**	**4728.60**	**4728.60**	**92541.77**
	142.0															

Notes

Emissions for MODU activities are estimated at the Potential to Emit (no fuel reduction measures).

BOEM FORM 0139 (March 2015 - Supersedes all previous versions of this form which may not be used).

COMPANY	AREA	BLOCK	LEASE	PLATFORM	WELL
Shell Offshore Inc	Alaminos Canyon	857	OCS-G 17565	DP MODU, DP Semi	GD 002/ 002Alt drlg and well work (incl. workover and maintenance)
Year	**Emitted**			**Substance**	
	PM	**SOx**	**NOx**	**VOC**	**CO**
			AQR Emissions if DP MODU(Semi-sub or Drillship) is Utilized		
2018-2030	**137.55**	**78.87**	**4728.06**	**141.85**	**1031.58**
Allowable	**4728.60**	**4728.60**	**4728.60**	**4728.60**	**92541.77**

Notes

Emissions for MODU activities are estimated at the Potential to Emit (no fuel reduction measures).

SECTION 9 – OIL SPILL INFORMATION

All the proposed activities and facilities in this plan will be covered by the Regional OSRP filed by Shell Offshore Inc. (0689) in accordance with 30 CFR 550 and 30 CFR 254, and approved by BSEE in June 2017. The bi-annual review was found to be in compliance October 2017.

Spill Response Sites:

Primary Response Equipment Locations	Preplanned Staging Location(s)
Ingleside, TX; Galveston, TX; Venice, LA; Ft Jackson, LA; Harvey, LA; Stennis, MS; Pascagoula, MS; Theodore, AL; Tampa, FL	Galveston, TX; Port Fourchon; Venice, LA; Pascagoula, MS ; Mobile, AL; Tampa, FL

OSRO Information:

The names of the oil spill removal organizations (OSRO's) under contract include Clean Gulf Associates (CGA), Marine Spill Response Company (MSRC) and Oil Spill Response Limited (OSRL). These OSRO's provide equipment and will in some cases provide trained personnel to operate their response equipment (OSRVs, etc.) and Shell also has the option to pull from their trained personnel as needed for assistance/expertise in the Command Post and in the field.

Worst Case Scenario Determination:

	Drilling		Production	
Category	**Regional OSRP**	**DOCD**	**Regional OSRP**	**DOCD**
Type of Activity	Subsea Drilling	Frio Subsea	Production >10 miles to shore	Perdido Great White Unit
Facility Location (area/block)	MC 812	AC 857	MC 812	AC 857
Facility Designation	Subsea well B◇	Well A12◇◇	Subsea well B	Well A12
Distance to Nearest Shoreline (miles)	59	142	59	142
Volume Storage tanks (total) Flowlines (on facility) Pipelines Uncontrolled blowout (volume per day) Total Volume	 N/A N/A N/A 468,000 BOPD* 468,000 BOPD	 0 Bbls 0 Bbls 0 Bbls 129,000 BOPD** 129,000 BOPD	 16,600 Bbls 100 Bbls 27,428 Bbls 468,000 BOPD 512,128❖	 4,000 Bbls 100 Bbls 8,300 Bbls 129,000 BOPD** 141,400 BOPD
Type of Oil(s) - (crude oil, condensate, diesel)	Crude oil	Crude oil	Crude oil	Crude oil
API Gravity(s)	31°	34°	37.5°	34°

***24-hour rate (432,000 BOPD 30-day average) **24- hour rate (79,100 BOPD 30-day average)**

◇ This well was reviewed and accepted by BOEM in plan N-9840. ◇◇ This well was reviewed and accepted by BOEM in Plan R-5144.
❖This new number was accepted by BOEM in plan N-9989

Shell Offshore Inc. has the capability to respond to the appropriate worst-case spill scenario included in its Regional OSRP, approved by BSEE June 2017. The bi-annual review was found to be in compliance October 2017. Since the worst-case scenario determined for our Plan does not replace the appropriate worst-case scenario in our regional OSRP, I hereby certify that Shell Offshore Inc. has the capability to respond, to the maximum extent practicable, to a worst-case discharge, or a substantial threat of such a discharge, resulting from the activities proposed in our plan.

Modeling:

Based on the requirement per NTL 2008-G04 and the outcome of the OSRAM Model, Shell Offshore Inc. determined no additional modeling was needed for potential oil or hazardous substance spill for operations proposed in this exploration plan, as the current, approved OSRP adequately meets the necessary response capabilities.

SECTION 10: ENVIRONMENTAL MONITORING INFORMATION

A. Monitoring Systems

A rig based Acoustic Doppler Current Profiler (ADCP) is used to continuously monitor the current beneath the rig. Metocean conditions such as sea states, wind speed, ocean currents, etc. will also be continuously monitored. Shell will comply with NTL 2015-G04.

B. Incidental Takes

No incidental takes are anticipated. Although marine mammals may be seen in the area, Shell does not believe that its operations proposed under this EP will result Shell implements the mitigation measures and monitors for incidental takes of protected species according to the following notices to lessees and operators from the BOEM/BSEE:

NTL 2015-BSEE-G03	"Marine Trash and Debris Awareness and Elimination"
NTL 2016-BOEM-G01	"Vessel Strike Avoidance and Injured/Dead Protected Species Reporting"
NTL 2016-BOEM-G02	"Implementation of Seismic Survey Mitigation Measures & Protected Species Observer Program"

C. Flower Garden Banks National Marine Sanctuary

The operations proposed in this plan will not be conducted within the Protective Zones of the Flower Garden Banks and Stetson Bank.

SECTION 11: LEASE STIPULATIONS INFORMATION

OCS-G 17565 is not a part of any Biological Sensitive Area, Shipping Fairway, or designated as having a high potential for containing archeological properties. It is located in Military Warning Area W-602 and Shell will enter into an agreement with the commander prior to commencing operations.

SECTION 12: ENVIRONMENTAL MITIGATION MEASURE INFORMATION

A. Impacts to Marine and coastal environments

The proposed action will implement mitigation measures required by laws and regulations, including all applicable Federal & State requirements concerning air emissions, discharges to water and solid waste disposal, as well as any additional permit requirements and Shell policies. Project activities will be conducted in accordance with the Regional OSRP. Section 18 of this plan discusses impacts and mitigation measures, including Coastal Habitats and Protected Areas.

B. Incidental Takes

We do not anticipate any incidental takes related to the proposed operations. Shell implements the mitigation measures and monitors for incidental takes of protected species according to the following notices to lessees and operators from the BOEM/BSEE:

NTL 2015-BSEE-G03	"Marine Trash and Debris Awareness and Elimination"
NTL 2016-BOEM-G01	"Vessel Strike Avoidance and Injured/Dead Protected Species Reporting"
NTL 2016-BOEM-G02	"NTL 2012-Joint-G02 "Implementation of Seismic Survey Mitigation Measures & Protected Species Observer Program"

SECTION 13: RELATED FACILITIES AND OPERATIONS INFORMATION

A. Related OCS Facilities and Operations

This revised DOCD covers two subsea wells (one producer and one back-up) to be produced to the Perdido Regional Host in AC 857. We are revising the length of the jumper for this GD002 well. There are no new flowlines or subsea assemblies associated with this plan.

B. Transportation System

No additional flowlines are anticipated because of the activities proposed in this plan.

C. Produced liquid hydrocarbons transportation vessels

Not applicable.

SECTION 14: SUPPORT VESSELS AND AIRCRAFT

A. General

Type	Maximum Fuel Tank Storage Capacity (Gals)	Maximum No. In Area at Any Time	Trip Frequency or Duration
Crew Boats	8,000	2	Twice per week
Offshore Support Vessels	120,000	3	Twice per week
Helicopter	760	1	Once per day

B. Diesel Oil Supply Vessels

Size of Fuel Supply Vessel	Capacity of Fuel Supply Vessel	Frequency of Fuel Transfers	Route Fuel Supply Vessel Will Take
280-foot length	100,000 gals.	1 week	Port Fourchon to AC857

C. Drilling Fluids Transportation

Type of Material	Quantity Being Transported	Transportation Method
Dry Bulk (Cement, Barite, Gel)	12,000 sx max combined	Below deck dry bulk tanks onboard OSV
Synthetic-base drilling fluids	11,000 bbls max per voyage	Tanks below deck onboard OSV

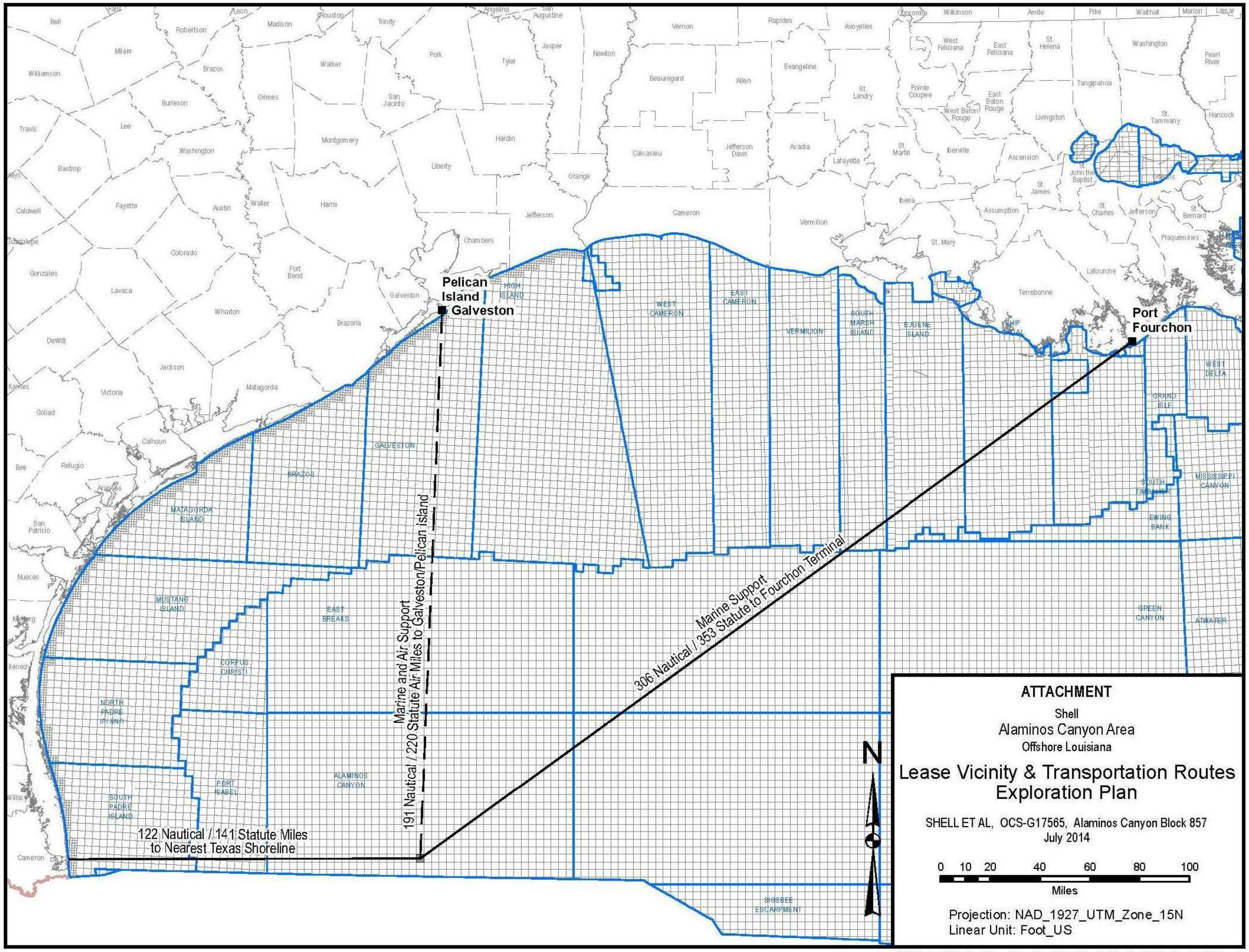
D. Solid and Liquid Wastes Transportation

See Section 7, Table 7B.

E. Vicinity Map

See Attachment 14A.

Attachment 14A – Vicinity Map



G:\30_Project\CAD_NewOrleans\Maps\Permit Plats\Perdido\Perdido Vicinity Map July 2014.mxd

SECTION 15: ONSHORE SUPPORT FACILITIES INFORMATION

A. General

Name	Location	Existing/New/Modified
Fourchon	Port Fourchon, LA	Existing
Galveston PHI Heliport	Galveston, TX	Existing

The existing onshore support base for air transportation will be PHI Heliport in Galveston, TX located at 2215 Terminal Drive. The existing onshore base for installation water traffic will be the Fourchon Terminal located on Bayou LaFourche, south of Leesville, LA approximately three miles from the Gulf of Mexico. Marine support for the drilling operation will be from Halliburton located at 1800 Seawolf Parkway in Galveston, TX or Martin Midstream at Pelican Island in Galveston, TX.

B. Support Base Construction or Expansion

This does not apply to this plan as Shell does not plan to construct a new onshore support base or expand an existing one to accommodate the activities proposed in this EP.

C. Support Base Construction or Expansion Timetable

Since no onshore support base construction or expansion is planned for these activities, a timetable for land acquisition and construction or expansion is not applicable.

D. Waste Disposal

See Section 7, Tables 7A and 7B.

E. Air emissions

Not required by BOEM GOM.

F. Unusual solid and liquid wastes

Not required by BOEM GOM.

SECTION 16: SULPHUR OPERATIONS INFORMATION

Information regarding Sulphur Operations is not included in this plan as we are not proposing to conduct sulphur operations.

SECTION 17: COASTAL ZONE MANAGEMENT ACT (CZMA) INFORMATION

Coastal zone consistency has been provided from the State of Louisiana and the State of Texas in plan R-5144 in 2011.

CZM concurrence is not required for Supplemental plans in these states.

SECTION 18 : ENVIRONMENTAL IMPACT ANALYSIS (EIA)

The following EIA was prepared for the original GD wells. The environmental impacts do not change.

Environmental Impact Analysis

REVISED DEVELOPMENT OPERATIONS
COORDINATION DOCUMENT
Alaminos Canyon Block 812 (OCS-G 24593)
Alaminos Canyon Block 813 (OCS-G 17561)
Alaminos Canyon Block 814 (OCS-G 20862)
Alaminos Canyon Block 856 (OCS-G 20870)
Alaminos Canyon Block 857 (OCS-G 17565)
Alaminos Canyon Block 900 (OCS-G 17570)
Alaminos Canyon Block 901 (OCS-G 17571)
Offshore Texas

10 January 2011

Prepared for:

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Acronyms and Abbreviations

AC	Alaminos Canyon
ADIOS	Automated Data Inquiry for Oil Spills
ASI	Airborne Support, Inc.
BOEMRE	Bureau of Ocean Energy Management, Regulation and Enforcement
BPD	barrels per day
CGA	Clean Gulf Associates
CH_4	methane
CO	carbon monoxide
CO_2	carbon dioxide
CZMA	Coastal Zone Management Act of 1972
DOCD	Development Operations Coordination Document
DP	dynamically positioned
EA	Environmental Assessment
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
EIA	Environmental Impact Analysis
EIS	Environmental Impact Statement
ESA	Endangered Species Act
FAD	fish-attracting device
GEMS	Geoscience Earth & Marine Services, Inc.
GMFMC	Gulf of Mexico Fishery Management Council
H_2S	hydrogen sulfide
HAPC	Habitat Area of Particular Concern
HSE	health, safety, and environment
IPF	impact-producing factor
ISO	International Organization for Standardization
MARPOL	International Convention for the Prevention of Pollution from Ships
MC	Mississippi Canyon
MGD	million gallons per day
MMBO	million barrels of oil
MMC	Marine Mammal Commission
MMPA	Marine Mammal Protection Act
MMS	Minerals Management Service
MSFCMA	Magnuson-Stevens Fishery Conservation and Management Act
MSRC	Marine Spill Response Corporation
MWCC	Marine Well Containment Company
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NO_x	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRC	National Research Council
NTL	Notice to Lessees
NWR	National Wildlife Refuge
OCS	Outer Continental Shelf
OCSLA	Outer Continental Shelf Lands Act
OSRA	Oil Spill Risk Analysis
OSRP	Oil Spill Response Plan
PAH	polycyclic aromatic hydrocarbon
PM	particulate matter
PSD	Prevention of Significant Deterioration
RDOCD	Revised Development Operations Coordination Document

Acronyms and Abbreviations
(Continued)

ROV	remotely operated vehicle
SBM	synthetic-based mud
SO_x	sulfur oxides
SWSS	Sperm Whale Seismic Study
USCG	U.S. Coast Guard
USDOI	U.S. Department of the Interior
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
VOC	volatile organic compound
WBM	water-based mud
WCD	worst case discharge
WCEP	Whooping Crane Eastern Partnership

Introduction

Project Summary

Shell Offshore Inc. (Shell) is submitting a Revised Development Operations Coordination Document (RDOCD) for Alaminos Canyon (AC) Blocks 812, 813, 814, 856, 857, 900, and 901.

This RDOCD includes drilling of 9 wells with surface locations in AC 857, including

- Six wells (SW Cluster wells GB05 & GB06 and Frio Wells GD1, GD2, GD3 and GD4) to be drilled by a dynamically positioned (DP) semisubmersible; and
- Three DVA wells to be drilled near/beneath the Perdido Regional Host by the H&P 205 platform rig. The wells are GA21, GA22, and GA23.

Although all of the surface locations are in AC 857, the RDOCD includes the other blocks listed above to encompass all of the bottom hole locations. Drilling of each well is estimated to require 90 days. All other operations remain as previously approved.

AC 857 is 142 miles (229 km) from the nearest shoreline and 219 miles (352 km) from the onshore support bases at Galveston, Texas (**Figure 1**). Water depth at the Perdido Host location is 2,382 m (7,816 ft). The other surface locations range in water depth from 2,402 to 2,572 m (7,880 to 8,439 ft). Water depth in AC 857 varies from 2,272 to 2,773 m (7,455 to 9,100 ft).

The Great White Field was discovered in April 2002 when the AC 857-1 exploratory well was drilled. A total of eight exploration and appraisal wells and one sidetrack have been drilled at Great White. During drilling of these previous wells, the reservoirs were fully logged and evaluated. In addition to the comprehensive 3D seismic data, substantial data associated with the reservoirs were gathered, including but not limited to core, pressure, and fluid data. Furthermore, the reservoirs are normally pressured and contain light to heavy hydrocarbons bearing no hydrogen sulfide (H_2S). The well design and drilling program proposed were developed using information gathered during drilling of the previous wells.

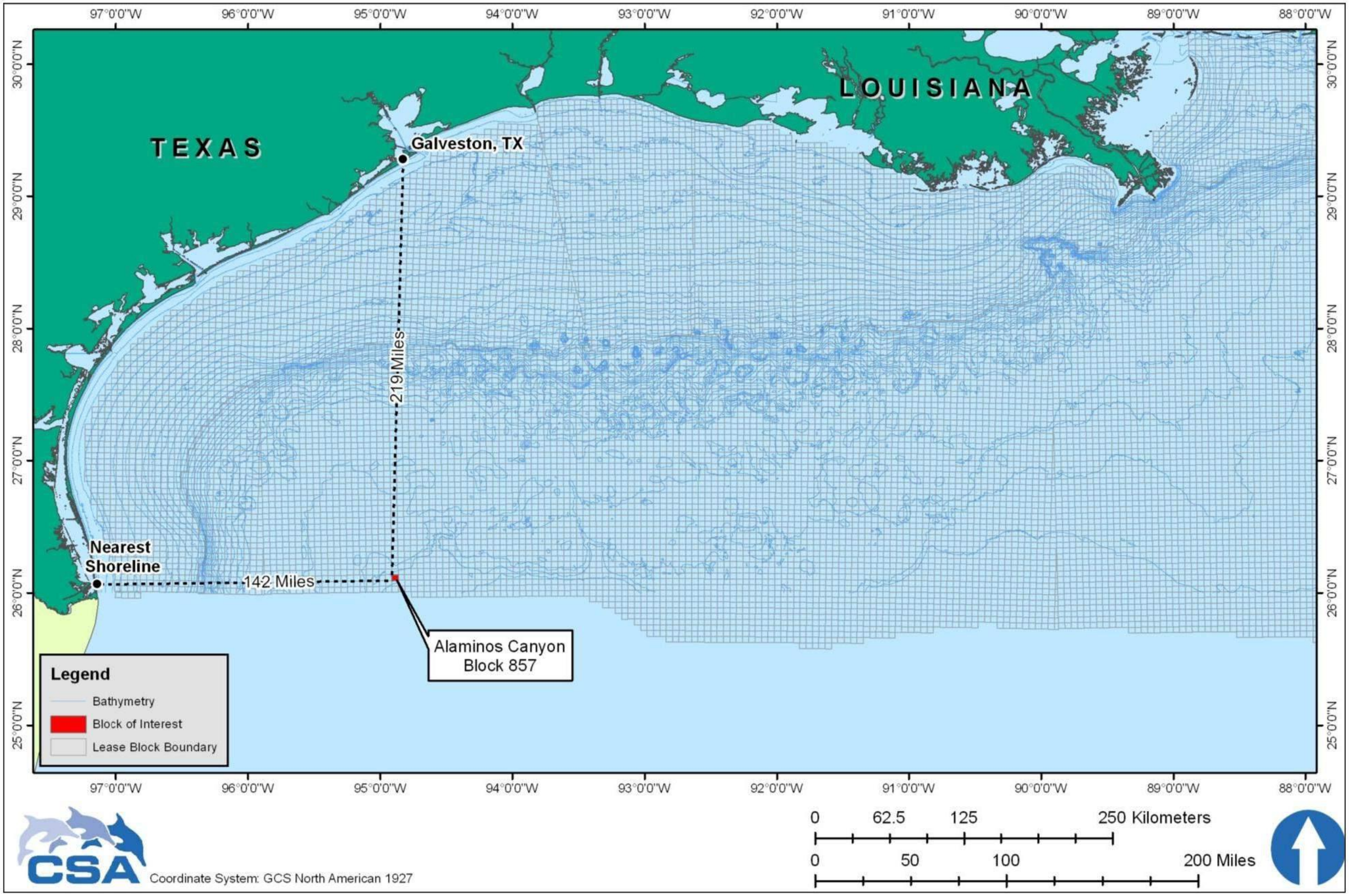

Figure 1. Vicinity map for the lease area (surface location).

Purpose of the EIA

This Environmental Impact Analysis (EIA) was prepared pursuant to the requirements of the Outer Continental Shelf Lands Act (OCSLA), 43 U.S.C. §§ 1331-1356, and BOEMRE regulations, including 30 CFR 250.242(s) and 250.261. The EIA is a project- and site-specific analysis of Shell's planned activities under this RDOCD. The EIA also evaluates potential impacts in accordance with Notice to Lessees (NTL) 2008-G04 issued by the BOEMRE. The EIA presents data, analysis, and conclusions to assist the BOEMRE in complying with the National Environmental Policy Act (NEPA) and other relevant Federal laws, including the Endangered Species Act (ESA) and Marine Mammal Protection Act (MMPA), as the agency considers this RDOCD for approval. It also identifies the mitigation measures Shell will implement in connection with the planned activities.

NTL 2008-G04 specifies that an EIA for a revised plan needs to address only those impact-producing factors (IPFs), resources, and impacts that are different from the original EIA. An EIA was submitted with the Initial DOCD approved on April 12, 2007 (Plan Control No. N-08809) and with Supplemental DOCDs approved on October 23, 2007 (Plan Control No. N-07127), February 14, 2008 (Plan Control No. S-07157), and July 30, 2009 (Plan Control No. S-07322). The issues review and analyses in the initial EIA concluded there would be no significant environmental impacts from the development project at the Great White Field. This revised EIA, which is submitted at the direction of BOEMRE, supplements the earlier EIA with information relevant to the revised blowout scenario and worst case discharge (WCD) information as required by NTL 2010-N06. As detailed herein, the issues reviewed and analyzed in this revised EIA confirm the conclusions of the initial EIA, and the BOEMRE (then MMS) Finding of No Significant Impact and determination that an Environmental Impact Statement (EIS) would not be required for the Great White Field.

BOEMRE has performed numerous environmental evaluations of oil and gas activities in the Gulf of Mexico Outer Continental Shelf (OCS). Potential impacts have been analyzed at a broad level in the Programmatic EIS for the OCS Oil and Gas Leasing Program (MMS, 2007a) and in recent multi-lease-sale EISs for the Western and Central Gulf of Mexico Planning Areas (MMS, 2007b, 2008), as well as the Environmental Assessment (EA) for Gulf of Mexico deepwater operations and activities (MMS, 2000) and a Grid EA for Shell's Perdido Development in AC 812, 813, 814, and 857 (MMS, 2007c). These studies provide data and a large body of knowledge on the Gulf of Mexico OCS. They analyze everything from potential impacts on the natural environment to the socioeconomic effects of exploration and development activities. They include numerous technical studies ranging from the likely trajectory of spilled oil to the effects of underwater noise on threatened and endangered species. They inform agency decision making on lease offerings, mitigation measures and lease stipulations, operational requirements, and permit restrictions. This substantial body of work, which in part forms the basis for the evaluation presented here, will allow BOEMRE and other regulatory agencies to evaluate Shell's RDOCD and ensure that oil and gas activities are performed in an environmentally sound manner, with minimal impacts on the environment. Shell has incorporated these comprehensive environmental analyses by reference and built on them with project-specific and site-specific analyses.

OCS Regulatory Framework

The regulatory framework for OCS activities in the Gulf of Mexico has been summarized by MMS (2010). Under the OCSLA, the U.S. Department of the Interior (USDOI) is responsible for the administration of mineral exploration and development of the OCS. Within the USDOI, the BOEMRE is charged with the responsibility of managing and regulating the development of OCS oil and gas resources in accordance with the provisions of the OCSLA. The BOEMRE operating regulations are in 30 CFR 250, 251, and 254.

In implementing its responsibilities under the OCSLA, the BOEMRE must consult with numerous Federal departments and agencies that have authority to govern and maintain ocean resources pursuant to other Federal laws. Among these are the U.S. Coast Guard (USCG), U.S. Environmental Protection Agency (USEPA), U.S. Fish and Wildlife Service (USFWS), and the National Oceanic and Atmospheric Administration (NOAA) through the National Marine Fisheries Service (NMFS). Federal regulations establish specific consultation and coordination processes with Federal, State, and local agencies (i.e., the ESA, MMPA, Coastal Zone Management Act of 1972 [CZMA], and the Magnuson-Stevens Fishery Conservation and Management Act [MSFCMA]).

NTLs are formal documents issued by the BOEMRE that provide clarification, description, or interpretation of a regulation or standard; provide guidelines on the implementation of a special lease stipulation or regional requirement; provide a better understanding of the scope and meaning of a regulation by explaining BOEMRE interpretation of a requirement; or transmit administrative information such as current telephone listings and a change in BOEMRE personnel or office address. **Table 1** lists and summarizes the NTLs referenced in this EIA.

Oil Spill Prevention and Contingency Planning

Shell submitted a Gulf of Mexico Regional Oil Spill Response Plan (OSRP) as a fundamental component of the planned drilling program on October 26, 2010. The OSRP demonstrates Shell's capabilities to rapidly and effectively manage oil spills that may result from drilling operations. Despite the extremely low likelihood of a large oil spill event occurring during the project, Shell has designed its response program based upon a regional capability of responding to a range of spill volumes that increase from small operational spills up to and including a WCD from a well blowout. Shell's program meets the response planning requirements of the relevant coastal states and Federal oil spill planning regulations. The OSRP includes information regarding Shell's regional oil spill organization and dedicated response assets, potential spill risks, and local environmental sensitivities. The OSRP presents specific information on the response program that includes a description of personnel and equipment mobilization, the incident management team organization, and the strategies and tactics used to implement effective and sustained spill containment and recovery operations.

EIA Organization

The EIA is organized into **Sections A** through **I** corresponding to the information required by NTL 2008-G04, which provides guidance regarding information required by 30 CFR Part 250 for DOCDs. The main impact-related discussions are in **Section A** (Impact-Producing Factors) and **Section C** (Impact Analysis).

Table 1. Notices to Lessees and Operators (NTLs) that are referenced in this Environmental Impact Analysis (EIA).

NTL	Title	Summary
2010-N10	Statement of Compliance with Applicable Regulations and Evaluation of Information Demonstrating Adequate Spill Response and Well Containment Resources	Informs operators using subsea blowout preventers (BOPs) or surface BOPs on floating facilities that applications for well permits must include a statement signed by an authorized company official stating that the operator will conduct all activities in compliance with all applicable regulations, including the increased safety measures regulations (75 FR 63346). Informs operators that BOEMRE will be evaluating whether each operator has submitted adequate information demonstrating that it has access to and can deploy containment resources to promptly respond to a blowout or other loss of well control.
2010-N06	Information Requirements for Exploration Plans, Development and Production Plans, and Development Operations Coordination Documents on the OCS	Rescinds the limitations set forth in NTL 2008-G04 regarding a blowout scenario and worst case discharge scenario, and provides guidance regarding the information required in blowout scenario and worst case discharge scenario descriptions.
2009-G40	Deepwater Benthic Communities	Guidance for avoiding and protecting high-density deepwater benthic communities (including chemosynthetic and deepwater coral communities) from damage caused by Outer Continental Shelf (OCS) oil and gas activities in water depths greater than 300 m (984 ft). Prescribes separation distances of 610 m (2,000 ft) from each mud and cuttings discharge location and 76 m (250 ft) from all other seafloor disturbances.
2009-G39	Biologically-Sensitive Underwater Features and Areas	Guidance for avoiding and protecting biologically sensitive features and areas (i.e., topographic features, pinnacles, low-relief live bottom areas, and other potentially sensitive biological features) when conducting OCS operations in water depths less than 300 m (984 ft) in the Gulf of Mexico.
2009-G06	Military Warning and Water Test Areas	Provides contact links to individual command headquarters for the military warning and water test areas in the Gulf of Mexico. Lease stipulations require lessees or designated operators to enter into an agreement with the appropriate individual military command headquarters concerning the control of electromagnetic emissions and use of boats and aircraft in the applicable warning area or water test area before commencing such traffic.

NTL	Title	Summary
2008-G04	Information Requirements for Exploration Plans and Development Operations Coordination Documents	Guidance on the information requirements for OCS plans, including EIA requirements and information regarding compliance with the provisions of the Endangered Species Act and Marine Mammal Protection Act.
2007-G04	Vessel Strike Avoidance and Injured/Dead Protected Species Reporting	Recommends protected species identification training, recommends that vessel operators and crews maintain a vigilant watch for marine mammals and slow down or stop their vessel to avoid striking protected species, and requires operators to report sightings of any injured or dead protected species.
2007-G03	Marine Trash and Debris Awareness and Elimination	Instructs operators to exercise caution in the handling and disposal of small items and packaging materials; requires the posting of placards at prominent locations on offshore vessels and structures; and mandates a yearly marine trash and debris awareness training and certification process.
2005-G07	Archaeological Resource Surveys and Reports	Provides guidance on regulations regarding archaeological discoveries, specifies requirements for archaeological resource surveys and reports, and outlines options for protecting archaeological resources.

A. Impact-Producing Factors

Table 2 is a matrix of IPFs and potentially affected environmental resources adapted from Form MMS-142. An "X" indicates that an IPF could reasonably be expected to affect a certain resource, and a dash (--) indicates no impact or negligible impact. Where there may be an effect, an analysis is provided in **Section C**. Potential IPFs for the proposed activity are listed below and discussed briefly in the following subsections:

- Drilling rig presence (including noise and lights);
- Physical disturbance to the seafloor;
- Air pollutant emissions;
- Effluent discharges;
- Water intake;
- Onshore waste disposal;
- Marine debris;
- Support vessel and helicopter traffic; and
- Accidents.

A.1 Drilling Rig Presence (including noise and lights)

Wells GB05, GB06, GD01, GD02, GD03, and GD04 will be drilled by a DP semisubmersible, the *Noble Danny Atkins*. The other wells will be drilled by the H&P 205 platform rig. Drilling of each well is estimated to require 90 days.

The physical presence of a floating structure in the ocean can attract pelagic fishes and other marine life as discussed in **Section C.5.1**. The *Noble Danny Atkins* has hull dimensions of 94 x 84 x 38 m (307 x 277 x 125 ft) and an operating draft of 24 m (82 ft). A semisubmersible maintains buoyancy using ballasted, watertight pontoons located below the sea surface. The operating deck is located above the tops of passing waves. Structural columns connect the pontoons and operating deck. When the rig moves its location, the pontoons are de-ballasted so that the rig can float on the sea surface and be towed by tugs. DP semisubmersibles are now common in the industry and do not represent new or unique technology.

The H&P 205 platform rig is a modular drilling unit that will attach to the Perdido Regional Host. The Perdido Regional Host is a spar consisting of a circular steel column moored to the seafloor by a 3 x 3 clustered configuration of nine mooring legs. The Host location is in the northwest quadrant of AC 857 in a water depth of approximately 2,382 m (7,816 ft). The platform rig will not contact the seafloor or significantly alter the structure of the Host.

Drilling operations produce noise that includes strong tonal components at low frequencies, including infrasonic frequencies in at least some cases (MMS, 2000). Drilling noise from semisubmersibles is not particularly intense and is strongest at low frequencies, averaging 10 to 500 Hz (Richardson et al., 1995). From a semisubmersible, sound and vibration paths to the water flow either through the air or through the risers (MMS, 2000). Drilling rigs also maintain exterior lighting for navigational and aviation safety in accordance with Federal regulations.

Table 2. Matrix of impact-producing factors and affected environmental resources. X = potential impact; dash (--) = no impact or negligible impact.

Environmental Resources	Impact-producing Factors								Accidents	
	Drilling Rig Presence (incl. noise & lights)	Physical Disturbance to Seafloor	Air Pollutant Emissions	Effluent Discharges	Water Intake	Onshore Waste Disposal	Marine Debris	Support Vessel/Helo Traffic	Small Fuel Spill	Oil Spill (WCD)
Physical/Chemical Environment										
Air quality and greenhouse gases	--	--	X(9)	--	--	--	--	--	X(6)	X(6)
Water quality	--	--	--	X	--	--	--	--	X(6)	X(6)
Seafloor Habitats and Biota										
Soft bottom benthic communities	--	--	--	X	--	--	--	--	--	X(6)
High-density deepwater benthic communities	--	--4)	--	--(4)	--	--	--	--	--	X(6)
Designated topographic features	--	--(1)	--	--(1)	--	--	--	--	--	--
Pinnacle trend area live bottoms	--	--(2)	--	--(2)	--	--	--	--	--	--
Eastern Gulf live bottoms	--	--(3)	--	--(3)	--	--	--	--	--	--
Threatened, Endangered, and Protected Species and Critical Habitat										
Sperm whale (endangered)	X(8)	--	--	--	--	--	--	X(8)	X(6,8)	X(6,8)
Florida manatee (endangered)	--	--	--	--	--	--	--	X(8)	--	X(6,8)
Endangered mysticete whales	--	--	--	--	--	--	--	--	--	--
Non-endangered marine mammals (protected)	X	--	--	--	--	--	--	X	X(6)	X(6)
Sea turtles (endangered/threatened)	X(8)	--	--	--	--	--	--	X(8)	X(6,8)	X(6,8)
Piping Plover (threatened)	--	--	--	--	--	--	--	--	--	X(6)
Whooping Crane (endangered)	--	--	--	--	--	--	--	--	--	X(6)
Gulf sturgeon (threatened)	--	--	--	--	--	--	--	--	--	--
Beach mice (endangered)	--	--	--	--	--	--	--	--	--	--
Coastal and Marine Birds										
Marine and pelagic birds	X	--	--	--	--	--	--	X	X(6)	X(6)
Shore birds and coastal nesting birds	--	--	--	--	--	--	--	X	--	X(6)
Fisheries Resources										
Pelagic communities and ichthyoplankton	X	--	--	X	X	--	--	--	X(6)	X(6)
Essential Fish Habitat	X	--	--	X	X	--	--	--	X(6)	X(6)
Archaeological Resources										
Shipwreck sites	--	--(7)	--	--	--	--	--	--	--	X(6)
Prehistoric archaeological sites	--	--(7)	--	--	--	--	--	--	--	X(6)
Coastal Habitats and Protected Areas										
Beaches	--	--	--	--	--	--	--	--	--	X(6)
Wetlands and seagrass beds	--	--	--	--	--	--	--	X	--	X(6)
Coastal wildlife refuges & wilderness areas	--	--	--	--	--	--	--	--	--	X(6)
Socioeconomic and Other Resources										
Recreational and commercial fishing	X	--	--	--	--	--	--	--	X(6)	X(6)
Public health and safety	--	--	--	--	--	--	--	--	--	X(6)
Employment and infrastructure	--	--	--	--	--	--	--	--	--	X(6)
Recreation and tourism	--	--	--	--	--	--	--	--	--	X(6)
Land use	--	--	--	--	--	--	--	--	--	X(6)
Other marine uses	--	--	--	--	--	--	--	--	--	X(6)

Table 2 Footnotes and Applicability:

(1) *Activities that may affect a marine sanctuary or topographic feature. Specifically, if the well, platform site, or any anchors will be on the seafloor within the following:*

(a) *4-mi zone of the Flower Garden Banks, or the 3-mi zone of Stetson Bank;*

(b) *1,000-m, 1-mi, or 3-mi zone of any topographic feature (submarine bank) protected by the Topographic Features Stipulation attached to an Outer Continental Shelf (OCS) lease;*

(c) *Essential Fish Habitat (EFH) criteria of 500 ft from any no-activity zone; or*

(d) *Proximity of any submarine bank (500-ft buffer zone) with relief greater than 2 m that is not protected by the Topographic Features Stipulation attached to an OCS lease.*

- Not applicable. The lease is not within or near any marine sanctuary, topographic feature, or no-activity zone. There are no submarine banks in the block.

(2) *Activities with any bottom disturbance within an OCS lease block protected through the Live Bottom (Pinnacle Trend) Stipulation attached to an OCS lease.*

- The Live Bottom (Pinnacle Trend) Stipulation is not applicable to the lease area.

(3) *Activities within any Eastern Gulf OCS block where seafloor habitats are protected by the Live Bottom (Low-Relief) Stipulation attached to an OCS lease.*

- The Live Bottom (Low-Relief) Stipulation is not applicable to the lease area.

(4) *Activities on blocks designated by the BOEMRE as being in water depths 300 m or greater.*

- No impacts on high-density deepwater benthic communities are anticipated. There are no features indicative of high-density chemosynthetic communities or coral communities within 610 m (2,000 ft) of any drilling mud/cuttings discharge. Because a DP semisubmersible and a platform rig will be used, there will be no anchoring.

(5) *Exploration or production activities where H_2S concentrations greater than 500 ppm might be encountered.*

- Not applicable. Shell has requested that BOEMRE classify the area as "H_2S absent." Fluid samples from nearby Great White exploration and appraisal wells have shown zero H_2S content.

(6) *All activities that could result in an accidental spill of produced liquid hydrocarbons or diesel fuel that you determine would impact these environmental resources. If the proposed action is located a sufficient distance from a resource that no impact would occur, the EIA can note that in a sentence or two.*

- Accidental hydrocarbon spills could affect the resources marked (X) in the matrix, and impacts are analyzed in **Section C**.

(7) *All activities that involve seafloor disturbances, including anchor emplacements, in any OCS block designated by the BOEMRE as having high-probability for the occurrence of shipwrecks or prehistoric sites, including such blocks that will be affected that are adjacent to the lease block in which your planned activity will occur. If the proposed activities are located a sufficient distance from a shipwreck or prehistoric site that no impact would occur, the EIA can note that in a sentence or two.*

- No impacts on archaeological resources are expected. The lease is not on the list of high-probability blocks for shipwrecks and is well beyond the 60-m depth contour used by the BOEMRE as the seaward extent for prehistoric archaeological site potential in the Gulf of Mexico.

(8) *All activities that you determine might have an adverse effect on endangered or threatened marine mammals or sea turtles or their critical habitats.*

- IPFs that may affect marine mammals, sea turtles, or their critical habitats include drilling rig presence and emissions, support vessel and helicopter traffic, and accidents. See **Section C**.

(9) *Production activities that involve transportation of produced fluids to shore using shuttle tankers or barges.*

- Not applicable.

A.2 Physical Disturbance to the Seafloor

Because a DP semisubmersible and a platform rig will be used for drilling, there will be no anchoring and no physical disturbance to the seafloor during drilling. The DP semisubmersible is a floating rig that maintains its position using thrusters. The platform rig will attach to the existing spar and will not contact the seafloor.

A.3 Air Pollutant Emissions

Air pollutant emissions are estimated in **RDOCD Section 8**. Offshore air pollutant emissions will result from operations of the drilling rigs, as well as service vessels and helicopters. These emissions occur mainly from combustion of diesel fuel. The combustion of fuels occurs on diesel-powered generators, pumps, or motors and from lighter fuel motors. Primary air pollutants typically associated with OCS activities are suspended particulate matter (PM), sulfur oxides (SOx), nitrogen oxides (NOx), volatile organic compounds (VOCs), and carbon monoxide (CO).

The Air Quality Emissions Report prepared in accordance with BOEMRE requirements shows that the projected emissions are below exemption levels; therefore, according to 30 CFR 250.303 the emissions will not significantly affect the air quality of the onshore area for any of the criteria pollutants. No further analysis or control measures are required. However, Shell will use low sulfur fuel (0.05% by weight) to further reduce any possible impacts.

A.4 Effluent Discharges

Effluent discharges are summarized in **RDOCD Section 7**. All offshore discharges will be in accordance with the National Pollutant Discharge Elimination System (NPDES) General Permit No. GMG290000 issued by the USEPA. Discharges will be in compliance with and monitored as required by the permit.

A synthetic-based mud (SBM) system will be used at all of the wellsites. The SBM will not be discharged but will be recovered and transported to the shore base for recycling by the mud company. Washed SBM cuttings will be discharged overboard after treatment with a cuttings dryer, which is expected to reduce retention on cuttings to approximately 2.4%, well below the NPDES permit requirement of 6.9%. The estimated volume of cleaned SBM cuttings to be discharged is 4,000 bbl/well.

During the initial well intervals at GB05, GB06, GD01, GD02, GD03, and GD04, water-based mud (WBM) and cuttings will be released at the seafloor before the marine riser is set that allows returns to the surface. The estimated discharge volumes are 4,000 bbl/well of WBM and 450 bbl of WBM cuttings. Excess cement slurry will also be released at the seafloor during casing installation for the riserless portion of the drilling operations at these wellsites. The other 3 wells have been pre-jetted and the remaining well intervals will be drilled with SBM only; there will be no seafloor releases at these wellsites.

Other effluent discharges in accordance with the NPDES permit will include excess cement, non-contact cooling water, treated sanitary and domestic wastes, deck drainage, desalination unit brine, uncontaminated fire water, and ballast water.

A.5 Water Intake

Seawater will be drawn from the ocean for once-through, non-contact cooling of machinery on the drilling rigs. The estimated intake and discharge of cooling water is 456,343 bbl/day (BPD) (19.2 million gallons per day [MGD]).

Section 316(b) of the Clean Water Act requires NPDES permits to ensure that the location, design, construction, and capacity of cooling water intake structures reflect the best technology available to minimize adverse environmental impact from impingement and entrainment of aquatic organisms. Neither the *Noble Danny Atkins* nor the H&P 205 are "new" facilities as defined by the NPDES permit (those that started construction after July 16, 2006) and therefore they are not subject to the cooling water intake regulations. The current general NPDES permit No. GMG 290000 does not specify requirements for existing facilities.

A.6 Onshore Waste Disposal

Wastes generated during drilling are tabulated in **RDOCD Section 7**. Volumes are estimated to be 300 bbl/month, including approximately 100 bbl/month of recyclables. Non-recyclable trash will be disposed at either Republic BFI Colonial Landfill (Sorrento, LA) or Safety Kleen Systems (Denton, TX). Paper, plastics, aluminum cans, cardboard will be recycled at ARC of New Iberia via the Recycle the Gulf Program. Recyclable waste such as oily rags, oily pads, filters, used oil, used cooking oil, used antifreeze, empty drums, scrap hoses, etc. will be sent to Omega Waste Management (Patterson, LA) for "waste to energy" recycling. Universal waste such as used lamps, batteries, e-wastes, will be sent to Lamp Environmental Industries, Inc. (Hammond, LA) for recycling. At the onshore facilities, wastes will be recycled or disposed of according to all applicable regulations.

A.7 Marine Debris

Trash and debris released into the marine environment can harm marine mammals, turtles, and birds through entanglement and ingestion. Shell will adhere to the International Convention for the Prevention of Pollution from Ships (MARPOL 73/78) Annex V requirements, USEPA and USCG regulations, and MMS regulations and NTLs regarding solid wastes. BOEMRE regulations at 30 CFR 250.300(a) and (b)(6) prohibit operators from deliberately discharging containers and other similar materials (i.e., trash and debris) into the marine environment, and 30 CFR 250.300(c) requires durable identification markings on equipment, tools and containers (especially drums), and other material. USCG and USEPA regulations require operators to become proactive in avoiding accidental loss of solid waste items by developing waste management plans, posting informational placards, manifesting trash sent to shore, and using special precautions such as covering outside trash bins to prevent accidental loss of solid waste. Shell complies with NTL 2007-G03 that instructs operators to exercise caution in the handling and disposal of small items and packaging materials, requires the posting of placards at prominent locations on offshore vessels and structures, and mandates a yearly marine trash and debris awareness training and certification process. Shell's compliance with all applicable laws, regulations, and NTL 2007-G03 will avoid significant impacts on the environment.

A.8 Support Vessel and Helicopter Traffic

The existing onshore support base for air transportation will be PHI Heliport in Galveston, Texas. The existing onshore base for the drilling operation will be Halliburton located in Galveston or Martin Midstream at Pelican Island in Galveston. Shell will use existing shore-base facilities at both locations; no terminal expansion or construction is planned.

During drilling, the project will be supported by two crew boats and two supply vessels, each making two round-trips per week between the drilling rig and the onshore support base. The boats will normally move to the project area via the most direct route from the supply base.

A helicopter will make one round-trip daily between the drilling rig and the support base in Galveston. The helicopter will be used to transport personnel and small supplies and will normally take the most direct route of travel between Galveston and the project area when air traffic and weather conditions permit. Helicopters typically maintain a minimum altitude of 213 m (700 ft) while in transit offshore, 305 m (1,000 ft) over unpopulated areas or across coastlines, and 610 m (2,000 ft) over populated areas and sensitive habitats such as wildlife refuges and park properties.

A.9 Accidents

A.9.1 Types of Accidents Evaluated

The analysis in this EIA focuses on two potential accidents:

- A small fuel spill, which is the most likely type of spill during OCS development activities; and
- The WCD for this RDOCD is a crude oil spill resulting from an uncontrolled blowout. In accordance with NTL 2010-N06, the estimated rate is 129,000 BPD for the first day with a 30-day average of 78,700 BPD. The estimated time to drill a relief well is 100 days and the total volume of a spill over this duration would be 5.4 million barrels of oil (MMBO).

The following subsections summarize assumptions about the size and fate of these spills, as well as Shell's spill response plans. Impacts are analyzed in **Section C**.

The lease sale EIS (MMS, 2007b) analyzes three other types of accidents: chemical spills, vessel collisions, and loss of well control. These accidents are discussed briefly in **Section A.9.4**.

A.9.2 Small Fuel Spill

Spill Size. According to the analysis in MMS (2007b), the most likely type of small spill (<1,000 bbl) as a result of OCS activities is a minor diesel fuel spill. Historically, most diesel spills have been ≤1 bbl, and this size is predicted to be the most common in ongoing and future OCS activities in the Western and Central Gulf of Mexico Planning Areas (MMS, 2007b). The average size for spills ≤1 bbl is 0.07 bbl, and the median size for spills of 1 to 10 bbl is 3 bbl (MMS, 2007b). For this analysis, a small diesel fuel spill of 3 bbl is assumed. Operational experience suggests that the most likely cause of such a spill would be a hose rupture resulting in the loss of the contents of a fuel transfer hose, which is less than 3 bbl.

Spill Fate. The fate of a small fuel spill in the lease area would depend on meteorological and oceanographic conditions at the time, as well as the effectiveness of spill response activities.

However, given the open ocean location of the lease area, the duration of a small spill and the opportunity for impacts to occur would be very brief.

The water-soluble fractions of diesel are dominated by two- and three-ringed polycyclic aromatic hydrocarbons (PAHs), which are moderately volatile (National Research Council [NRC], 2003). The constituents of these oils are light to intermediate in molecular weight and can be readily degraded by aerobic microbial oxidation. Diesel is so light that it will not sink to the seafloor. Diesel dispersed in the water column can adhere to suspended sediments, but this generally only occurs in coastal areas with high suspended solids loads (NRC, 2003), and would not be expected to occur to any appreciable degree in offshore waters of the Gulf of Mexico. Diesel oil is readily and completely degraded by naturally occurring microbes (NOAA, 2006).

The fate of a small diesel fuel spill was estimated using NOAA's ADIOS2 (Automated Data Inquiry for Oil Spills) model. This model uses the physical properties of oils in its database to predict the rate of evaporation and dispersion over time, as well as changes in the density, viscosity, and water content of the product spilled. It is estimated that over 90% of a small diesel spill would be evaporated or dispersed within 24 hours. The area of the sea surface with diesel fuel on it would range from 0.5 to 5 ha (1.2 to 12 ac) depending on sea state and weather conditions.

The ADIOS2 results, coupled with spill trajectory information discussed below for a large spill, indicate that a small fuel spill would not have any impacts on coastal or shoreline resources. AC 857 is approximately 142 miles (229 km) from the nearest coastline (Texas). Modeling results discussed below indicate that a spill in the lease area would not contact any shoreline within 3 days after a spill. By this time, essentially 100% of a small fuel spill would have been dispersed or evaporated by natural processes, without taking into account Shell's response measures. MMS (2007b) similarly concluded that spills <1,000 bbl are not expected to persist as a slick on the surface of the water beyond a few days and are unlikely to make landfall or reach coastal waters prior to breaking up. MMS (2007b) noted that this conclusion is supported by a previous analysis of 3-day trajectory model runs, previous weathering analyses, and historical records of spill incidents.

Spill Response. In the unlikely event the shipboard prevention procedures fail to prevent a fuel spill, response equipment and trained personnel would be available to ensure that any spill effects are localized and would result only in short-term environmental consequences. **RDOCD Section 9b** provides a detailed discussion of Shell's response to a spill.

A.9.3 Crude Oil Spill (Worst Case Discharge)

Spill Size. In accordance with requirements of NTL 2010-N06, Shell has estimated a WCD for this RDOCD as 129,000 BPD for the first day with a 30-day average of 78,700 BPD. The estimated time to drill a relief well is 100 days and the total volume of a spill over this duration would be 5.4 MMBO. The detailed analysis of this calculation can be found in **RDOCD Section 2j**.

Historically, blowouts are rare events and most do not result in oil spills. Holand (1997) estimated a probability of 0.00142 for a blowout during development drilling based on U.S. Gulf of Mexico data. An updated analysis using the SINTEF database estimates a blowout frequency of 0.00035 per development well for non-North Sea locations (International Association of Oil & Gas Producers, 2010). As noted by MMS (2007b), from 1992 to 2005, half of blowouts lasted less than half a day, and fewer than 10% of blowouts resulted in spilled oil.

The risk of a blowout during this project is significantly lower than indicated by these statistics because the well design and drilling program were developed using information gathered during the drilling of the previous Great White wells. During drilling of the previous wells, the reservoir was fully logged and evaluated. In addition to the comprehensive 3D seismic data, substantial data associated with the reservoir were gathered, including but not limited to core, pressure, and fluid data. Furthermore, the reservoir was normally pressured and contained light, non-H_2S bearing hydrocarbons. Data gained during these earlier operations provide substantial information that was used in preparing for the proposed operation.

Shell has a robust system in place to prevent blowouts. Included in **RDOCD Sections 2j** and **9b** is Shell's response to NTL 2010-N06, which includes descriptions of measures to prevent a blowout, reduce the likelihood of a blowout, and conduct effective and early intervention in the event of a blowout. Shell will also comply with NTL 2010-N10 and the Interim Final Drilling Safety Rule, which specify additional safety measures for OCS activities.

Spill Trajectory. The fate of a large oil spill in the lease area would depend on meteorological and oceanographic conditions at the time. The Oil Spill Risk Analysis (OSRA) model is a computer simulation of oil spill transport that uses realistic data for winds and currents to predict spill fate. The OSRA report by Ji et al. (2004) provides conditional contact probabilities for shoreline segments. The results for Launch Area 11 (where AC 857 is located) are presented in **Table 3**. The model predicts no shoreline contacts within 3 days of a spill. After 10 days, there is a 1% contact probability for six Texas counties (Cameron, Kennedy, Kleberg, Aransas, Calhoun, and Matagorda). After 30 days, 12 counties or parishes may be contacted, including 11 Texas counties and 1 Louisiana parish. Matagorda County, Texas, has the highest probability of contact (10%) for the 30-day interval.

Table 3. Conditional probabilities of a spill in the lease area contacting shoreline segments (From: Ji et al., 2004). Values are conditional probabilities that a hypothetical spill in the lease area (represented by Oil Spill Risk Analysis Launch Area 11) could contact shoreline segments within 3, 10, or 30 days.

Shoreline	County or Parish and State	Conditional Probability of Contact[a] (%)		
		3	10	30
C01	Cameron, Texas	--	1	5
C02	Willacy, Texas	--	--	2
C03	Kennedy, Texas	--	1	8
C04	Kleberg, Texas	--	1	6
C05	Nueces, Texas	--	--	4
C06	Aransas, Texas	--	1	5
C07	Calhoun, Texas	--	1	6
C08	Matagorda, Texas	--	1	10
C09	Brazoria, Texas	--	--	2
C10	Galveston, Texas	--	--	3
C12	Jefferson, Texas	--	--	1
C13	Cameron, Louisiana	--	--	1

[a] Conditional probability refers to the probability of contact within the stated time period, assuming that a spill has occurred (-- indicates less than 0.5%).

The OSRA model does not evaluate the fate of a spill over time periods longer than 30 days, nor does it predict the fate of a release that continues over a period of weeks or months. Also as noted by Ji et al. (2004), the OSRA model does not take into account the chemical composition or biological weathering of oil spills, the spreading and splitting of oil spills, or spill response activities. The model does not assume a particular spill size but has generally been used by the BOEMRE/MMS to evaluate contact probabilities for spills greater than 1,000 bbl.

Weathering. Following an oil spill, several physical, chemical, and biological processes, collectively called weathering, interact to change the physical and chemical properties of the oil, and thereby influence its harmful effects on marine organisms and ecosystems. The most important weathering processes include spreading, evaporation, dissolution, dispersion into the water column, formation of water-in-oil emulsions, photochemical oxidation, microbial degradation, adsorption to suspended particulate matter, and stranding on shore or sedimentation to the seafloor (NRC, 2003).

Weathering decreases the concentration of oil and produces changes in its chemical composition, physical properties, and toxicity. The more toxic, light aromatic and aliphatic hydrocarbons are lost rapidly by evaporation and dissolution from the slick on the water surface. Evaporated hydrocarbons are degraded rapidly by sunlight. Biodegradation of oil on the water surface and in the water column by marine bacteria removes first the n-alkanes and then the light aromatics from the oil. Other petroleum components are biodegraded more slowly. Photooxidation attacks mainly the medium and high molecular weight PAHs in the oil on the water surface.

Spill Response. Shell is a member of both the Marine Spill Response Corporation (MSRC) and Clean Gulf Associates (CGA) to provide the resources necessary to respond to a spill as outlined in its Regional OSRP. Shell is also a founding member of the Marine Well Containment Company (MWCC) and will have access to an integrated subsea well control and containment system that can be rapidly deployed through the MWCC, which is expected to be in place by the first quarter 2012. The MWCC is a non-profit organization that will own, manage, and provide fully trained crews and will operate the subsea containment system during a response. For more immediate subsea well control and containment capabilities, Shell is pursuing mutual aid agreements, formal contracts for the BP containment equipment, and other call-off contracts for necessary response vessels.

The experience of gaining control over the Macondo well has resulted in a better understanding of the necessary equipment and systems for well containment. As a result, industry and government are better equipped and prepared today to contain an oil well blowout in deepwater (see page 17 of the Decision Memorandum dated October 1, 2010). Shell is further analyzing these advances and incorporating them into its comprehensive approach to help prevent and, if needed, control another deepwater control incident. Shell is also investing in research and development to improve containment systems.

The primary offshore response would involve mechanical recovery. The primary response equipment that would be mobilized for spills in normal and adverse weather conditions to this location is listed in the Offshore On-Water Recovery Activation List in the OSRP.

Chemical dispersion capabilities are also readily available from resources such as MSRC in Stennis, Mississippi, and Coolidge, Arizona; CGA/Airborne Support, Inc. (ASI) in Houma, Louisiana; Oil Spill Response in South Hampton, UK and Singapore; and the Clean Caribbean & Americas in Ft. Lauderdale. Available dispersant application equipment (including the use of subsea dispersants), response times, and support resources are identified in the OSRP.

Open-water *in-situ* burning may also be used as a response strategy, depending on the circumstances of the release. If appropriate conditions exist and approval from the Unified

Command is received, one or multiple *in-situ* burning task forces could be deployed offshore depending on weather conditions.

See **RDOCD Sections 2j** and **9b** for a detailed description of Shell's site-specific response to the worst case spill for this plan. These sections, along with Shell's OSRP, also include a description of surface and subsea containment capabilities that could be implemented in the event of the worst case spill for this plan.

A.9.4 Other Accidents Not Analyzed in Detail

The lease sale EIS (MMS, 2007b) discusses three other types of accidents: chemical spills, vessel collisions, and loss of well control. These accidents are discussed briefly below along with an H_2S release, and there are no other site-specific issues for this RDOCD. The analysis in the lease sale EIS for these topics is incorporated by reference.

<u>Chemical Spill</u>. Chemicals used in drilling operations are required to overcome technical issues in the drilling process, improve the efficiency and safety of drilling, and protect associated equipment. To perform these tasks, a variety of chemicals may be mixed together to develop the site-specific properties required in drilling the wells. Examples of chemicals used to achieve these properties include surfactants, bentonite clays, olefins, inorganic salts, nut shells, glycols, polymers, barite, and calcium carbonate. Supplies are renewed on a regular basis by transfer in containers from supply boats (Boehm et al., 2001). Other than chemicals used in drilling fluids, examples of chemicals that may be found on or transported to the rig include ethylene glycol (blowout prevention control fluid, closed cooling loops for crane and main engines and brake coolers), cement (used to cement casing in place), solvents (used in painting operations), hydraulic fluids (used in cranes and other hydraulic rig equipment), lubricating oil and grease (used in reciprocating and electrical equipment), and sodium hypochlorite (dilute, used as laundry bleach and disinfectant).

A study of environmental risks of chemical products used in OCS activities determined that only two chemicals could potentially affect the marine environment: zinc bromide and ammonium chloride (Boehm et al., 2001). Neither of these chemicals will be used for well treatment or completion. The risk of a spill for these chemicals is very low. Most other chemicals are either nontoxic or used in small quantities. No significant impacts are expected from chemical spills.

<u>Vessel Collisions</u>. As summarized in MMS (2007b), vessel collisions occasionally occur during routine operations. Most collision mishaps are the result of service vessels colliding with platforms or vessel collisions with pipeline risers. Some of these collisions have caused spills of diesel fuel or chemicals. Shell will comply with all USCG and BOEMRE-mandated safety requirements to minimize the potential for vessel collisions.

<u>Loss of Well Control</u>. A loss of well control is the uncontrolled flow of a reservoir fluid that may result in the release of gas, condensate, oil, drilling fluids, sand, or water. Loss of well control is a broad term that includes very minor up to the most serious well control incidents, while blowouts are considered to be a subset of more serious incidents with greater risk of oil spill or human injury (MMS, 2007b). Loss of well control may result in the release of synthetic drilling fluid or loss of oil. Shell has a robust system in place to prevent loss of well control. Included in this RDOCD is Shell's response to NTL 2010-N06, which includes descriptions of measures to prevent a blowout, reduce the likelihood of a blowout, and conduct effective and early intervention in the event of a blowout. Shell will also comply with NTL 2010-N10 and the Interim Final Drilling Safety

Rule, which specify additional safety measures for OCS activities. See **RDOCD Sections 2j** and **9b** for further information.

H_2S Release. Based on 30 CFR 250.67 (c), Shell has requested that the BOEMRE classify the lease as an area where the absence of H_2S has been confirmed. Fluid samples obtained from Great White exploration and appraisal wells were found to have zero H_2S content. Therefore, no significant impacts on the environment are expected from an H_2S release.

B. Affected Environment

The lease area is in the northwestern Gulf of Mexico, 142 miles (229 km) from the nearest shoreline, and 219 miles (352 km) south of the onshore support base at Galveston, Texas (**Figure 1**). AC 857 is near the base of the continental slope, west-southwest of Alaminos Canyon (**Figure 2**). Perdido Canyon lies to the north of AC 857, encroaching on the extreme northern boundary of the block. The principal topographic feature of AC 857 is a topographic high and associated escarpment, which plunges from southwest to northeast where it encounters the Perdido Canyon. Escarpments mark the foot of the Texas/Louisiana continental slope in this area (Martin and Bouma, 1978).

A detailed description of the regional affected environment is provided in recent EISs (MMS, 2007b, 2008), including meteorology, oceanography, geology, air and water quality, benthic communities, threatened and endangered species, biologically sensitive resources, archaeological resources, socioeconomic conditions, and other marine uses. These regional descriptions are based on extensive literature reviews and are incorporated by reference. General background information is presented below, and brief descriptions of each potentially affected resource are presented in **Section C**, including site-specific and/or new information if available.

Aside from the aforementioned canyon and escarpment features, the local environment in the lease area is not known to be unique with respect to physical/chemical, biological, or socioeconomic conditions. Baseline environmental conditions in the lease area are expected to be consistent with the regional description of continental slope locations evaluated in recent lease sale EISs (MMS, 2007b, 2008).

The lease area is located approximately 435 miles (700 km) west-southwest of the Macondo spill site. Based on an analysis of satellite imagery (ESRI, 2010), the surface slick did not extend over the lease area at any time, and there have been no documented impacts on the environment or the resources in the vicinity of the proposed wells. Therefore, the Macondo spill did not change the existing environmental conditions at the lease area. The impacts of the spill on the environment/resources in the northeastern Gulf of Mexico are currently under investigation. Macondo spill impacts are addressed in **Section C.9** (Cumulative Impacts) where information is available and applicable.

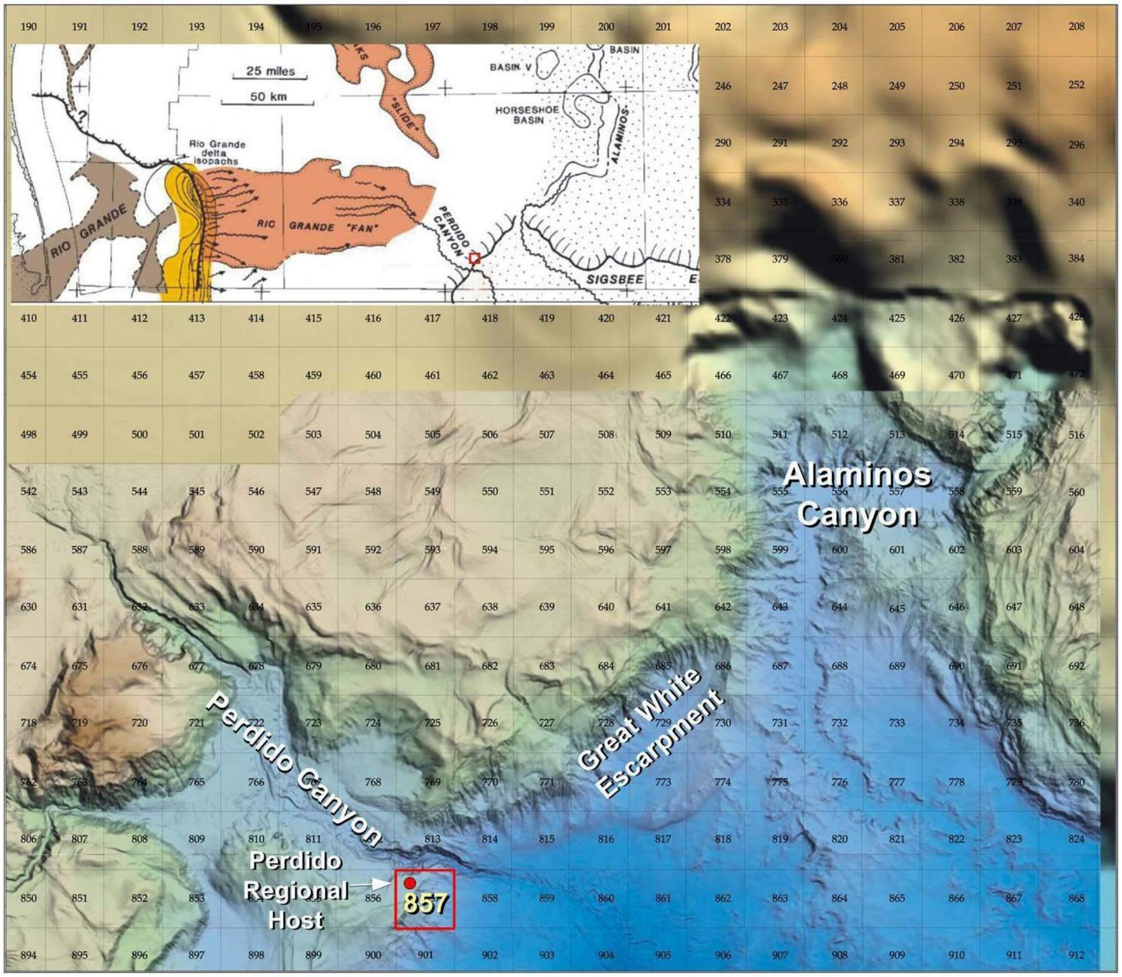

Figure 2. Location of Alaminos Canyon Block 857 at the base of the continental slope in relation to Alaminos Canyon and Perdido Canyon (Adapted from: Geoscience Earth & Marine Services, Inc., 2005a).

C. Impact Analysis

This section analyses the potential direct and indirect impacts of routine activities and accidents. Cumulative impacts are discussed in **Section C.9**.

Impacts have been analyzed extensively in recent multi-lease-sale EISs for the Western and Central Gulf of Mexico Planning Areas (MMS, 2007b, 2008) as well as the environmental assessment for Gulf of Mexico deepwater operations and activities (MMS, 2000) and a Grid EA for Shell's Perdido Development in AC 812, 813, 814, and 857 (MMS, 2007c). The EIA for the original DOCD analyzed impacts of drilling wells in AC 815 and 857, as well as installing subsea facilities including sleds, flowlines, and umbilicals. Site-specific issues are addressed in this section as appropriate.

C.1 Physical/Chemical Environment

C.1.1 Air Quality

There are no site-specific air quality data for the project area. Due to the distance from shore-based pollution sources, offshore air quality is expected to be good. The attainment status of Federal OCS waters is unclassified because there is no provision in the Clean Air Act for classification of areas outside State waters (MMS, 2007b).

As of January 2011, all Louisiana, Mississippi, Alabama, and Florida coastal counties and parishes are in attainment of the National Ambient Air Quality Standards (NAAQS) for all criteria pollutants (USEPA, 2010a). Three metropolitan areas in Texas are nonattainment areas for 8-h ozone (Beaumont-Port Arthur, Dallas-Fort Worth, and Houston-Brazoria), and El Paso County is a nonattainment area for PM-10 (USEPA, 2010a).

Winds in the region are driven by the clockwise circulation around the Bermuda High (MMS, 2007b). The Gulf of Mexico is located to the southwest of this center of circulation, resulting in a prevailing southeasterly to southerly flow, which is conducive to transporting emissions toward shore. However, circulation is also affected by tropical cyclones (hurricanes) during summer and fall, and by extratropical cyclones (cold fronts) during winter.

IPFs potentially affecting air quality are air pollutant emissions and two types of accidents: a small fuel spill and a large oil spill (WCD).

Impacts of Air Pollutant Emissions

Air pollutant emissions are the only routine IPF likely to affect air quality. Offshore air pollutant emissions will result from the drilling rig operations and helicopters and service vessels. These emissions occur mainly from combustion or burning of diesel fuel. The combustion of fuels occurs primarily on diesel-powered generators, pumps, or motors and from lighter fuel motors. Primary air pollutants typically associated with OCS activities are suspended PM, SO_x, NO_x, VOCs, and CO.

Due to the distance from shore, routine operations in the project area are not expected to have any impact on air quality conditions along the coast, including nonattainment areas. As noted in the lease sale EIS (MMS, 2007b) emissions of air pollutants from routine activities in the Western Planning Area are projected to have minimal impacts to onshore air quality because of the prevailing atmospheric conditions, emission heights, emission rates, and the distance of these emissions from the coastline. The Air Quality Emissions Report (see **RDOCD Section 8**) prepared in accordance with BOEMRE requirements shows that the projected emissions are below exemption levels; therefore, according to 30 CFR 250.303 the emissions will not significantly affect the air quality of the onshore area for any of the criteria pollutants. No further analysis or control measures are required. However, Shell will use low sulfur fuel (0.05% by weight) to further reduce any possible impacts.

The Breton Wilderness Area, which is part of the Breton National Wildlife Refuge (NWR), is designated under the Clean Air Act as a Prevention of Significant Deterioration (PSD) Class I air quality area. The BOEMRE is required to notify the National Park Service (NPS) and USFWS if emissions from proposed projects may affect the Breton Class I area. Additional review and mitigation measures may be required for sources within 186 miles (300 km) of the Breton Class I area that exceed emission limits agreed upon by the administering agencies (NPS, 2010a). The lease area is approximately 415 miles (668 km) from the Breton Wilderness Area. Due to the distance and the projected emissions below the exemption levels, there will be no air quality impacts on the PSD Class I area.

Impacts of a Small Fuel Spill

Potential impacts of a small spill on air quality are expected to be consistent with those analyzed and discussed in recent EISs (MMS, 2007b, 2008). The probability of a small spill would be minimized by Shell's preventative measures during routine operations, including fuel transfer. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **RDOCD Sections 2j** and **9b** provide detail on spill response measures. Given the open ocean location of the lease area, the extent and duration of air quality impacts from a small spill would not be significant.

A small fuel spill would affect air quality near the spill site by introducing VOCs through evaporation. The ADIOS2 model (see **Section A.9.2**) indicates that over 90% of a small diesel spill would be evaporated or dispersed within 24 hours. The area of the sea surface with diesel fuel on it would range from 0.5 to 5 ha (1.2 to 12 ac) depending on sea state and weather conditions.

A small fuel spill would not affect coastal air quality because the spill would not be expected to make landfall or reach coastal waters prior to breaking up (see **Section A.9.2**).

Impacts of a Large Oil Spill (WCD)

Potential impacts of a large oil spill on air quality are expected to be consistent with those analyzed and discussed in recent EISs (MMS, 2007b, 2008).

A large oil spill (WCD) would affect air quality by introducing VOCs through evaporation from the slick. The extent and persistence of impacts would depend on the meteorological and oceanographic conditions at the time and the effectiveness of spill response measures. Additional air quality impacts could occur if response measures included *in-situ* burning of the floating oil. Burning would generate a plume of black smoke and result in emissions of NO_x, SO_x, CO, and PM, as well as greenhouse gases.

Due to the lease location 142 miles (229 km) from the nearest shoreline, most air quality impacts would occur in offshore waters. Depending on the spill trajectory and the effectiveness of spill response measures, coastal air quality could be affected. OSRA modeling predicts no shoreline contacts within 3 days of a spill (**Table 3**). After 30 days, 12 counties or parishes may be contacted, including 11 Texas counties and 1 Louisiana parish. Matagorda County, Texas, has the highest probability of contact (10%) for the 30-day interval.

A blowout resulting in a large oil spill (WCD) is an extremely rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in **RDOCD Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **RDOCD Sections 2j** and **9b** provide detail on spill response measures. Therefore, no significant spill impacts on air quality are expected.

C.1.2 Water Quality

There are no site-specific water quality data for the lease area. Due to the lease location in deep, offshore waters, water quality is expected to be good, with low levels of contaminants. As noted in the lease sale EIS (MMS, 2007b), deepwater areas in the northern Gulf of Mexico are relatively homogeneous with respect to temperature, salinity, and oxygen. Kennicutt (2000) noted that the deepwater region has little evidence of contaminants in the dissolved or particulate phases of the water column. However, there are localized occurrences of natural seepage of oil, gas, and brines in near-surface sediments and up through the water column.

The lease area is located approximately 435 miles (700 km) west-southwest of the Macondo spill site. Based on satellite imagery (ESRI, 2010), the surface slick did not extend over the lease area during the spill, and therefore existing water quality in the lease area has not been affected.

IPFs potentially affecting water quality are effluent discharges and two types of accidents: a small fuel spill and a large oil spill (WCD).

Impacts of Effluent Discharges

Discharges of WBM and washed SBM cuttings will produce temporary, localized increases in suspended solids in the water column around the drilling rig. In general, turbid water can be expected to extend between a few hundred meters and several kilometers down current from the discharge point (NRC, 1983; Neff, 1987). All NPDES permit limitations and requirements will be met. After discharge, SBM retained on cuttings would be expected to adhere tightly to the cuttings particles and, consequently, would not produce much turbidity as the cuttings sink through the water column (Neff et al., 2000). There will be no persistent impacts on water quality in the lease area.

Treated sanitary and domestic wastes may have a slight transient effect on water quality in the immediate vicinity of these discharges. All NPDES permit limitations and requirements will be met and little or no impact on water quality is anticipated.

Deck drainage includes all effluents resulting from rain, deck washings, and runoff from curbs, gutters, and drains, including drip pans in work areas. Rainwater that falls on uncontaminated areas of the drilling rig will flow overboard without treatment. However, rainwater that falls on the drilling rig deck and other areas such as chemical storage areas and places where equipment is exposed will be collected and oil and water separated to meet NPDES permit requirements. Little or no impact on water quality is anticipated.

Other discharges in accordance with the NPDES permit, such as desalination unit brine and uncontaminated cooling water, fire water, and ballast water are expected to be diluted rapidly and have little or no impact on water quality.

Support vessels will discharge treated sanitary and domestic wastes. These will have a slight effect on water quality in the immediate vicinity of the discharges. All support vessel discharges will be in accordance with USCG regulations and, as applicable, the NPDES Vessel General Permit, and therefore are not expected to cause significant impacts on water quality.

Impacts of a Small Fuel Spill

Potential impacts of a small spill on water quality are expected to be consistent with those analyzed and discussed in recent EISs (MMS, 2007b, 2008). The probability of a small spill would be minimized by Shell's preventative measures during routine operations, including fuel transfer. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **RDOCD Sections 2j** and **9b** provide detail on spill response measures. Given the open ocean location of the lease area, the extent and duration of water quality impacts from a small spill would not be significant.

A small fuel spill in offshore waters would produce a slick on the water surface and increase the concentrations of petroleum hydrocarbons and their degradation products. The extent and persistence of impacts would depend on the meteorological and oceanographic conditions at the time and the effectiveness of spill response measures. However, it is estimated that over 90% of a small diesel spill would be evaporated or dispersed within 24 hours (see **Section A.9.2**). The area of the sea surface with diesel fuel on it would range from 0.5 to 5 ha (1.2 to 12 ac) depending on sea state and weather conditions.

The water-soluble fractions of diesel are dominated by two- and three-ringed PAHs, which are moderately volatile (NRC, 2003). The constituents of these oils are light to intermediate in molecular weight and can be readily degraded by aerobic microbial oxidation. Diesel is so light that it is not possible for the oil to sink and pool on the seafloor. Diesel dispersed in the water column can adhere to suspended sediments, but this generally occurs only in coastal areas with high suspended solid loads (NRC, 2003), and would not be expected to occur to any appreciable degree in offshore waters of the Gulf of Mexico. Diesel oil is readily and completely degraded by naturally occurring microbes (NOAA, 2006).

A small fuel spill would not affect coastal water quality because the spill would not be expected to make landfall or reach coastal waters prior to breaking up (see **Section A.9.2**).

Impacts of a Large Oil Spill (WCD)

Potential impacts of a large oil spill on water quality are expected to be consistent with those analyzed and discussed in recent EISs (MMS, 2007b, 2008). A large spill would affect water quality by producing a slick on the water surface and increasing the concentrations of petroleum hydrocarbons and their degradation products. The extent and persistence of impacts would depend on the meteorological and oceanographic conditions at the time and the effectiveness of spill response measures. Most of the oil would be expected to form a slick at the surface, although new information from the Macondo spill indicates that plumes of submerged oil droplets can be produced when subsea dispersants are applied at the wellhead (Camilli et al., 2010; Hazen et al., 2010; Joint Analysis Group, 2010a,b,c). Small droplets in the water may adhere to suspended sediment and be removed from the water column.

Due to the lease location 142 miles (229 km) from the nearest shoreline, most water quality impacts would occur in offshore waters. Depending on the spill trajectory and the effectiveness of spill response measures, coastal water quality could be affected. OSRA modeling predicts no shoreline contacts within 3 days of a spill (**Table 3**). After 30 days, 12 counties or parishes may be contacted, including 11 Texas counties and 1 Louisiana parish. Based on the OSRA modeling predictions (**Table 3**), nearshore waters and embayments of Matagorda County, Texas, are the most likely coastal areas where water quality could be affected.

A blowout resulting in a large oil spill (WCD) is an extremely rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in **RDOCD Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **RDOCD Sections 2j** and **9b** provide detail on spill response measures. Therefore, no significant spill impacts on water quality are expected.

C.2 Seafloor Habitats and Biota

Water depth at the Perdido Host location is 2,382 m (7,816 ft). The other surface locations range in water depth from 2,402 to 2,572 m (7,880 to 8,439 ft). The seafloor is expected to consist mainly of soft bottom. Based on geological and remotely operated vehicle (ROV) survey reports prepared for the lease area by Geoscience Earth & Marine Services, Inc. (GEMS, 2001, 2004, 2005a,b) as summarized in **RDOCD Section 6(a)** , Shell has determined that there are no features that could support high-density deepwater benthic communities within 610 m (2,000 ft) of any wellsite.

C.2.1 Soft Bottom Benthic Communities

Data from the recent Northern Gulf of Mexico Continental Slope Habitats and Benthic Ecology study (Wei, 2006; Rowe and Kennicutt, 2009) can be used to describe typical benthic communities in the area. **Table 4** summarizes data from two nearby stations in similar water depths. Sediments at these two stations were predominantly clay (60%) and silt (35%).

Table 4. Benthic community data from stations near the lease area and in similar water depths sampled during the Northern Gulf of Mexico Continental Slope Habitats and Benthic Ecology Study (From: Wei, 2006; Rowe and Kennicutt, 2009).

Station	Location Relative to Lease Area	Water Depth (m)	Abundance		
			Meiofauna (individuals/m^2)	Macroinfauna (individuals/m^2)	Megafauna (individuals/ha)
AC1	26 mi NE	2,479	129,974	637	1,620
RW6	24 mi ESE	3,008	144,453	715	--

Meiofaunal and megafaunal abundance from Rowe and Kennicutt (2009); macroinfaunal abundance from Wei (2006).

Meiofauna (animals passing through a 0.5-mm sieve but retained on a 0.062-mm sieve) densities in water depths of the lease area typically range from about 100,000 to 200,000 individuals/m^2 (Rowe and Kennicutt, 2009). Data from nearby stations (**Table 4**) are within this range. Nematodes and harpacticoid copepods were the two dominant groups in the meiofauna, accounting for about 90% of total abundance.

The benthic macroinfauna is characterized by small mean individual sizes and low densities, both of which are a reflection of the meager primary production in Gulf of Mexico surface waters (Wei, 2006). Densities decrease exponentially with water depth. Based on an equation presented by Wei (2006), macroinfaunal densities in the water depth of the wellsites are expected to be about to 1,000 individuals/m^2, or slightly higher than the numbers in **Table 4**.

Polychaetes are typically the most abundant macroinfaunal group on the northern Gulf of Mexico continental slope, followed by amphipods, tanaids, bivalves, and isopods. Wei (2006) recognized four depth-dependent faunal zones (1 through 4), two of which are divided horizontally. The lease area is in Zone 3W, which consists of stations on the mid Texas-Louisiana Slope ranging in depth from 1,875 to 3,008 m. The five most abundant species in Zone 3W were the polychaetes *Levinsenia uncinata*, *Paraonella monilaris*, and *Tachytrypane* sp. A, the bivalve *Heterodonta* sp. B, and the isopod *Macrostylis* sp.

Megafaunal density from nearby station AC1 was 1,620 individuals/hectare (**Table 4**). Densities of 300 to 2,000 individuals/hectare were reported from other stations in a similar depth range. Common megafauna included motile groups such as decapods, ophiuroids, holothurians, and demersal fishes, as well as sessile groups such as sponges and anemones.

Bacteria are also an important component in terms of biomass and cycling of organic carbon (Cruz-Kaegi, 1998). Bacterial biomass at the depth range of the lease area typically is about 1 to 2 g C/m^2 in the top 15 cm of sediments (Rowe and Kennicutt, 2009).

IPFs potentially affecting benthic communities are effluent discharges (drilling muds and cuttings) and a large oil spill (WCD) resulting from a well blowout at the seafloor. Because the wells will be drilled by a DP semisubmersible and a platform rig, there will be no seafloor disturbance during drilling. A small fuel spill would not affect benthic communities because the diesel fuel would float and dissipate on the sea surface.

Impacts of Effluent Discharges

Drilling muds and cuttings are the only effluents that are likely to affect benthic communities. During initial well interval(s) before the marine riser is set at GB05, GB06, GD01, GD02, GD03, and GD04, cuttings and seawater-based "spud mud" will be released at the seafloor. Excess cement slurry will also be released at the seafloor during casing installation for the riserless portion of the drilling operations at these wellsites. Cement slurry components typically include cement mix and some of the same chemicals used in water-based drilling muds (Boehm et al., 2001). The other 3 wells have been pre-jetted and the remaining well intervals will be drilled with SBM only; there will be no seafloor releases at these wellsites.

The main impacts of seafloor releases will be burial and smothering of benthic organisms within several meters to tens of meters around the wellbore. Soft bottom sediments disturbed by cuttings, drilling muds, and cement slurry will eventually be recolonized through larval settlement and migration from adjacent areas. Because some deep-sea biota grow and reproduce slowly, recovery may require several years.

Discharges of washed SBM cuttings from the rig may affect benthic communities, primarily within several hundred meters of each wellsite. The fate and effects of SBM cuttings have been reviewed by Neff et al. (2000) and monitoring studies have been conducted in the Gulf of Mexico by Continental Shelf Associates, Inc. (2004, 2006). In general, washed cuttings with adhering SBMs tend to clump together and form thick cuttings piles close to the drillsite. Areas of SBM cuttings deposition may develop elevated organic carbon concentrations and anoxic conditions (Continental Shelf Associates, Inc., 2006). Where SBM cuttings accumulate and concentrations of the base fluid exceed approximately 1,000 mg/kg, benthic infaunal communities may be adversely affected due to both the toxicity of the base fluid and organic enrichment (with resulting anoxia) (Neff et al., 2000). Infaunal numbers may increase and diversity may decrease as opportunistic species that tolerate low oxygen and high H_2S predominate (Continental Shelf Associates, Inc., 2006). As the base synthetic fluid is decomposed by microbes, the area will gradually return to pre-drilling conditions. Disturbed sediments will be recolonized through larval settlement and migration from adjacent areas.

The extent and severity of seafloor impacts from washed SBM cuttings depends on the number of wells and the total volume discharged (Continental Shelf Associates, Inc., 2006). At wellsites GB05, GB06, GD01, GD02, GD03, and GD04, a single well will be drilled at each location and the impacts will be relatively minor. The 3 wells to be drilled beneath the Perdido Host could result in more severe and persistent impacts due to the relatively large volume of SBM cuttings to be discharged. This area has already been disturbed by installation of subsea facilities as well as seafloor WBM and cuttings releases during jetting of the 3 wells.

SBM cuttings accumulations in the lease area probably will be thinner and more diffuse than those observed in recent Gulf of Mexico monitoring studies (Continental Shelf Associates, Inc. (2004, 2006). Water depths in the lease area are about three times greater than the sites studied previously. The greater depth and the strong near-bottom currents flowing along the escarpment will allow greater dispersion of the cuttings as they settle and would be expected to result in thinner, more diffuse accumulations on the seafloor. Cuttings dispersal is also likely to be aided by Shell's low SBM retention on cuttings (2.4%); Neff et al. (2000) noted that cuttings tend to disperse more readily and are less likely to produce cuttings piles on the seafloor when SBM retention on cuttings is less than 5%.

In January 2005, an ROV survey in AC 857 observed a fine, white powder-like substance, assumed to be drill cuttings, covering the seabed in the vicinity of a previous wellsite. The cuttings were first observed approximately 84 m (275 ft) from the wellsite, increasing in thickness towards the wellsite. Side-scan sonar defined the fan-shaped cuttings splay extending for approximately 150 m (500 ft) to the southeast of the well location (GEMS, 2005b). This observation suggests that the assumption of a 500-m (1,640 ft) effect radius for drilling discharge impacts is conservative.

Assuming a typical effect radius of 500 m (1,640 ft), the affected area for each well would represent about 3% of the seafloor within AC 857. Counting the wells under the Perdido Host as a single location, the total impact area for seven surface locations would be about 21% of the seafloor in AC 857 and 3% of the area of the seven lease blocks included in this RDOCD. Soft-bottom communities are ubiquitous along the northern Gulf of Mexico continental slope (Gallaway, 1988; Gallaway et al., 2003; Rowe and Kennicutt, 2009). Impacts from drilling discharges during this project will have no significant impact on soft-bottom benthic communities on a regional basis. This conclusion is in accord with the findings of the Grid EA for the Perdido development (MMS, 2007c), which concluded that the project would have minimal impacts on the ecological function, biological productivity, or distribution of soft bottom communities.

Impacts of a Large Oil Spill (WCD)

The most likely effects of a subsea blowout on benthic communities would be within a few hundred meters of a wellsite. The MMS (2007b) estimates that a severe subsurface blowout could re-suspend and disperse sediments within a 300-m (984-ft) radius. While coarse sediments (sands) would probably settle at a rapid rate within 400 m (1,312 ft) from the blowout site, fine sediments (silts and clays) could be re-suspended for more than 30 days and dispersed over a much wider area. Based on previous studies, surface sediments at the project area are assumed to largely be silt and clay (Rowe and Kennicutt, 2009).

Previous analyses (MMS, 2007a, 2008) concluded that oil spills would be unlikely to affect benthic communities beyond the immediate vicinity of the wellhead (i.e., due to physical impacts of a blowout) because the oil would rise quickly to the sea surface directly over the spill location. However, during the Macondo spill, subsurface plumes were reported at a water depth of about 1,100 m (3,600 ft), extending at least 22 miles (35 km) from the wellsite and persisting for more than a month (Camilli et al., 2010). The subsurface plumes apparently resulted from the use of dispersants at the wellhead (Joint Analysis Group, 2010c). While the behavior and impacts of subsurface plumes are not well known, a subsurface plume could contact the seafloor and affect benthic communities beyond the 300 m (984 ft) radius estimated by MMS (2007a, 2008) depending on its extent, trajectory, and persistence. This contact could result in smothering and/or toxicity to benthic organisms. The affected area would be recolonized by benthic organisms over a period of months to years (NRC, 2003).

A blowout resulting in a large oil spill (WCD) is an extremely rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in **RDOCD Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **RDOCD Sections 2j** and **9b** provide detail on spill response measures. Therefore, no significant spill impacts on soft-bottom communities are expected.

C.2.2 High-Density Deepwater Benthic Communities

As defined by NTL 2009-G40, high-density deepwater benthic communities are features or areas that could support high-density chemosynthetic communities, or features or areas that could support high-density deepwater corals and other associated high-density hard bottom communities. Chemosynthetic communities were discovered in the central Gulf of Mexico in 1984 and have been studied extensively (MacDonald, 2002). Deepwater coral communities are also known from numerous locations in the Gulf of Mexico (Brooke and Schroeder, 2007; CSA International, Inc., 2007). These communities occur almost exclusively on authigenic carbonates created by chemosynthetic communities.

Chemosynthetic communities are known from AC 857 and several nearby lease blocks. In AC 857, there are small, scattered patches of tube worms and mussel beds that occur along a gully-like expulsion trend that cuts across the face of the Great White Escarpment in the northern half of the block (**Figure 3**). Varying amounts of seepage occur on the seabed above these amorphous trends (GEMS, 2005a,b). Extensive tracks with no visible evidence are interrupted by zones of discolored seabed and patches of bacteria. Limited areas, generally associated with the deepest depressions, contain significant chemosynthetic communities (i.e., mussel beds and tube worms). The most prolific area with chemosynthetic life also has live oil seeps and very irregular, crater and mound morphology (GEMS, 2005a,b). The areas of significant communities have a distinctive rough or rocky texture on sonar. This sonar character is also seen in expulsion features to the south in AC 901 but is not associated with features near the center of AC 857.

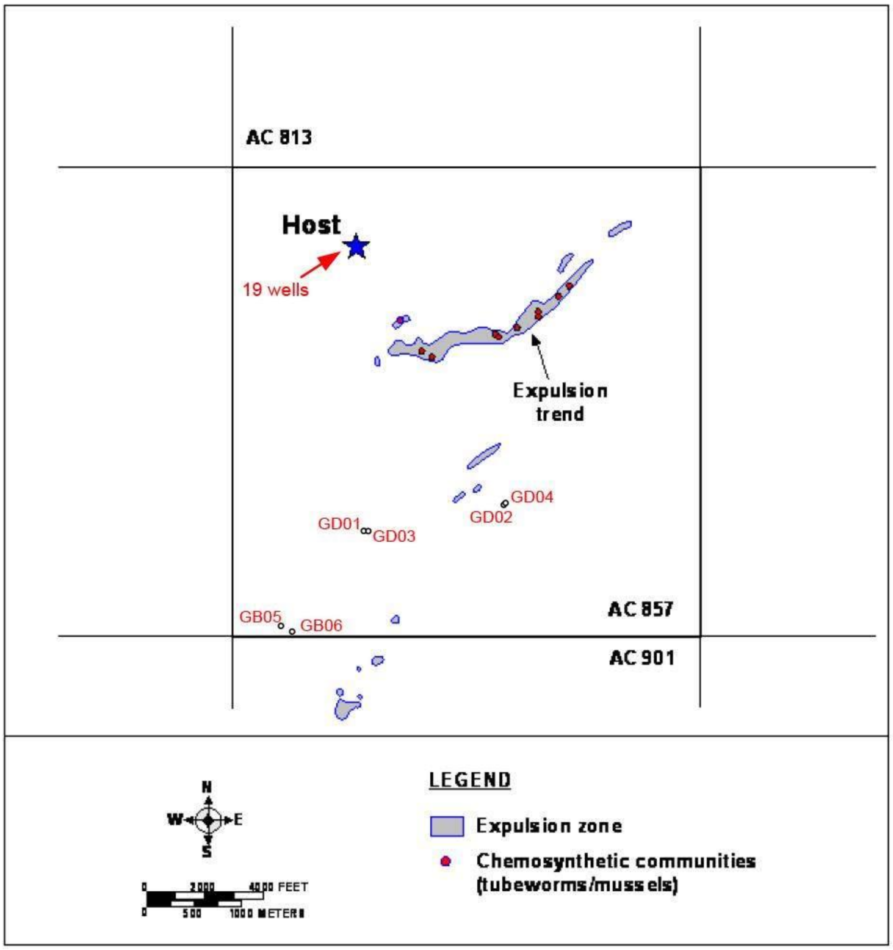

Figure 3. Location of fluid expulsion zones and chemosynthetic communities in the lease area.

Two wellsites, GD02 and GD04, are located about 305 m (1,000 ft) southeast of a possible fluid expulsion area near the center of AC 857. However, the analysis by GEMS (2005a) concluded that this area is unlikely to have significant chemosynthetic communities or other high-density deepwater benthic communities. These expulsion zones are relatively small and elliptical, and the acoustically amorphous sediments as defined by the subbottom profiler data are generally buried by varying thickness of the acoustically transparent sediment drape. GEMS concluded that these zones are unlikely to have significant communities based on the seafloor texture as defined by the sonar data. The expulsion zones near the middle of AC 857 do not exhibit the acoustically rough seafloor texture, and the slight textural variations along the seabed suggest that small patches of bacteria and seep-stained sediments are probable (GEMS, 2005a).

To summarize, high-density chemosynthetic communities have been identified in the lease area, primarily along the expulsion trend in the northern half of the block and also in the northern portion of AC 901. However, there are no high-density deepwater benthic communities within 610 m (2,000 ft) of any proposed drilling mud/cuttings discharge location. See **RDOCD Section 6(a)** for further information.

A chemosynthetic community site known as Neptune's Garden is located in AC 645, approximately 20 miles (32 km) northeast of the lease area along the margin of Alaminos Canyon.

This was the first deepwater hydrocarbon seep community discovered in the Gulf of Mexico. At this location, clusters of tube worms and mussel beds occur in association with carbonate outcrops in 2,200 m (7,217 ft) of water (Brooks et al., 1990). Another site northeast of the lease area has been studied in AC 818 in a water depth of 2,800 m (9,187 ft). At this site, investigators are studying tubeworm growth and have also seen a new species of clam with sulfur-oxidizing symbionts (NOAA, 2007).

IPFs potentially affecting high-density deepwater benthic communities are effluent discharges (drilling muds and cuttings), and a large oil spill (WCD) from a well blowout at the seafloor. A small fuel spill would not affect benthic communities because the diesel fuel would float and dissipate on the sea surface. Because a DP semisubmersible and a platform rig will be used, there will be no anchoring impacts.

Impacts of Effluent Discharges

For high-density deepwater benthic communities, the primary concern related to muds and cuttings discharges is burial (MMS, 2007b). Although chemosynthetic organisms thrive with some part of their anatomy located next to or inside of toxic and/or anoxic environments, all chemosynthetic megafauna (also including their symbiotic bacteria) also require oxygen to live. Burial by drilling discharges could smother and kill chemosynthetic organisms (motile clams being one possible exception).

Significant impacts on high-density deepwater benthic communities in the lease area are unlikely because the shallow hazards assessment determined that these communities are not present 610 m (2,000 ft) of any proposed drilling mud/cuttings discharge location. Monitoring programs on the Gulf of Mexico continental slope have shown that benthic impacts from SBM cuttings discharges typically are concentrated within about 500 m (1,640 ft) of the wellsite, although detectable deposits may extend beyond this distance (Continental Shelf Associates, Inc., 2004, 2006; Neff et al., 2005). This assumption is supported by observations from a previous wellsite in AC 857 in which cuttings particles were seen by an ROV within 84 m (275 ft) from the wellsite and side-scan sonar defined a fan-shaped cuttings splay extending for approximately 150 m (500 ft) from the well location (GEMS, 2005b). Although small amounts of cuttings particles may reach areas inhabited by high-density deepwater benthic communities in AC 857, the discharges are not expected to result in significant impacts to these communities.

As noted previously, wellsites GD02 and GD04 are located about 305 m (1,000 ft) southeast of a possible fluid expulsion area near the center of AC 857. However, the analysis by GEMS (2005a) concluded that this area is unlikely to have significant chemosynthetic communities or other high-density deepwater benthic communities. The slight textural variations along the seabed suggest that small patches of bacteria and seep-stained sediments are probable (GEMS, 2005a).

The 3 wells drilled at the Perdido Host location have the potential to produce the most extensive benthic impacts due to the relatively large volume of SBM cuttings to be discharged from the drilling rig. The Host location is approximately 1,200 m (4,000 ft) northwest of the main fluid expulsion feature in AC 857, which does support high-density chemosynthetic communities (GEMS, 2005a). Near-bottom currents in the lease area tend to flow northeast-to-southwest along the escarpment. Due to the distance, the water depth, the current patterns, and the low SBM retention on cuttings, drilling discharges are unlikely to accumulate in significant quantities on the expulsion feature and the associated communities.

Impacts of a Large Oil Spill (WCD)

Previous analyses (MMS, 2007a, 2008) concluded that oil spills would be unlikely to affect benthic communities beyond the immediate vicinity of the wellhead (i.e., due to physical impacts of a blowout) because the oil would rise quickly to the sea surface directly over the spill location. However, during the Macondo spill, subsurface plumes were reported at a water depth of about 1,100 m (3,600 ft), extending at least 22 miles (35 km) from the wellsite and persisting for more than a month (Camilli et al., 2010). The subsurface plumes apparently resulted from the use of dispersants at the wellhead (Joint Analysis Group, 2010c). While the behavior and impacts of subsurface plumes are not well known, a subsurface plume could have the potential to contact high-density deepwater benthic communities beyond the 300-m (984-ft) radius estimated by MMS (2007a, 2008) depending on its extent, trajectory, and persistence. Potential impacts on sensitive resources would be an integral part of the decision and approval process for the use of dispersants.

Potential impacts of oil on high-density deepwater benthic communities are discussed by MMS (2007b). Although chemosynthetic communities live among hydrocarbon seeps, natural seepage is very constant and occurs at low rates as compared to the potential rates of oil release from a blowout. In addition, seep organisms also require unrestricted access to oxygenated water at the same time as exposure to hydrocarbon energy sources (MacDonald, 2002). Oil droplets or oiled sediment particles could come into contact with chemosynthetic organisms or deepwater corals. As discussed by MMS (2007b), impacts could include loss of habitat, biodiversity, and live coral coverage; destruction of hard substrate; change in sediment characteristics; and reduction or loss of one or more commercial and recreational fishery habitats. Sublethal effects could be long-lasting and affect the resilience of coral colonies to natural disturbances (e.g., elevated water temperature and diseases).

The potential for spill to affect deepwater corals is indicated by preliminary findings from a recent (October 2010) survey of deepwater coral habitats near the Macondo spill site (BOEMRE, 2010). Government and academic researchers were working at a site 1,400 m (4,600 ft) deep and approximately 7 miles (11 km) southwest of the Macondo wellhead when they visually observed dead and dying corals with sloughing tissue and discoloration. Much of the soft coral observed in an area measuring about 15 to 40 m was covered by what appeared to be a brown substance. Ninety percent of 40 large corals were heavily affected and showed dead and dying parts and discoloration. Another site 400 m away had a colony of stony coral similarly affected and partially covered with a similar brown substance. Until laboratory analyses are conducted, scientists cannot be certain what caused the impacts. Sediment and coral samples were collected with the remotely operated vehicle and brought to the surface for analyses. Further testing will also determine if the substance is oil, and if so, whether it is consistent with the release from the Macondo spill.

A blowout resulting in a large oil spill (WCD) is an extremely rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in **RDOCD Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **RDOCD Sections 2j** and **9b** provide detail on spill response measures. Therefore, no significant spill impacts on deepwater benthic communities are expected.

C.2.3 Designated Topographic Features

The block is not within or near a designated topographic feature or a no-activity zone as identified in NTL 2009-G39. The nearest topographic feature is Mysterious Bank (North Padre Island East Addition Blocks A83 and A84), located approximately 118 miles (190 km) to the west-northwest. The West Flower Garden Bank is 132 miles (212 km) to the north-northeast.

There are no IPFs associated with either routine operations or accidents that could cause impacts to designated topographic features due to the distance from the lease area. A small fuel spill would float and dissipate on the surface and would not reach these seafloor features.

In the event of an oil spill from a well blowout, a surface slick would not contact these seafloor features. If a subsurface plume were to occur, impacts on these features would be unlikely due to the distance and the difference in water depth. Near-bottom currents in the lease area are predicted to flow toward the southwest along the escarpment (Nowlin et al., 2001) and typically would not carry a plume up onto the continental shelf.

C.2.4 Pinnacle Trend Area Live Bottoms

The lease area is not covered by the Live Bottom (Pinnacle Trend) Stipulation. As defined by NTL 2009-G39, the pinnacle trend area is about 450 miles (725 km) northeast from the lease area, along the shelf edge south of Alabama.

There are no IPFs associated with either routine operations or accidents that could cause impacts to pinnacle trend area live bottoms due to the distance from the lease area. A small fuel spill would float on the surface and would not reach these seafloor features.

In the event of an oil spill from a well blowout, a surface slick would not contact these seafloor features. If a subsurface plume were to occur, impacts on these features would be unlikely due to the distance and the difference in water depth. Near-bottom currents in the lease area are predicted to flow toward the southwest along the escarpment (Nowlin et al., 2001) and typically would not carry a plume up onto the continental shelf.

C.2.5 Eastern Gulf Live Bottoms

The lease area is not covered by the Live Bottom (Low-Relief) Stipulation, which applies to Eastern Planning Area leases in water depths of 100 m (328 ft) or less. The nearest live bottom areas, as defined by NTL 2009-G39, are about 485 miles (780 km) northeast from the project area.

There are no IPFs associated with either routine operations or accidents that could cause impacts to eastern Gulf live bottom areas due to the distance from the lease area. A small fuel spill would float and dissipate on the surface and would not reach these seafloor features.

In the event of an oil spill from a well blowout, a surface slick would not contact these seafloor features. If a subsurface plume were to occur, impacts on these features would be unlikely due to the distance and the difference in water depth. Near-bottom currents in the lease area are predicted to flow toward the southwest along the escarpment (Nowlin et al., 2001) and typically would not carry a plume up onto the continental shelf.

C.3 Threatened, Endangered, and Protected Species and Critical Habitat

This section discusses species listed as endangered or threatened under the ESA. In addition, it includes all marine mammal species in the region, which are protected under the MMPA.

Endangered or threatened species that may occur in the project area and/or along the northern Gulf coast are listed in **Table 5**. The table also indicates the location of critical habitat (if designated in the Gulf of Mexico). Critical habitat is defined as (1) specific areas within the geographical area occupied by the species at the time of listing, if they contain physical or biological features essential to conservation, and those features may require special management considerations or protection; and (2) specific areas outside the geographical area occupied by the species if the agency determines that the area itself is essential for conservation. The NMFS has jurisdiction for ESA-listed cetaceans, sea turtles, and fishes in the Gulf of Mexico. The USFWS has jurisdiction for ESA-listed birds and the Florida manatee.

Table 5. Federally-listed endangered and threatened species in the lease area and along the northern Gulf coast.

Species	Scientific Name		Potential Presence		Critical Habitat Designated in Gulf of Mexico
			Lease Area		
Marine Mammals					
Sperm whale	*Physeter macrocephalus*		X		None
Florida manatee	*Trichechus manatus latirostris*		--		Florida (Peninsular)
Blue whale	*Balaenoptera musculus*		X[a]		None
Fin whale	*Balaenoptera physalus*		X[a]		None
Humpback whale	*Megaptera novaeangliae*		X[a]		None
North Atlantic right whale	*Eubalaena glacialis*		X[a]		None
Sei whale	*Balaenoptera borealis*		X[a]		None
Sea Turtles					
Loggerhead turtle	*Caretta caretta*		X		None
Green turtle	*Chelonia mydas*		X		None
Leatherback turtle	*Dermochelys coriacea*		X		None
Hawksbill turtle	*Eretmochelys imbricata*		X		None
Kemp's ridley turtle	*Lepidochelys kempii*		X		None
Birds					
Piping Plover	*Charadrius melodus*		--		Coastal Texas, Louisiana, Mississippi, Alabama, and Florida (Panhandle)
Whooping Crane	*Grus americana*		--		Coastal Texas (Aransas NWR)
Fishes					
Gulf sturgeon	*Acipenser oxyrinchus desotoi*		--		Coastal Louisiana, Mississippi, Alabama, and Florida (Panhandle)
Terrestrial Mammals					
Beach mice (Alabama, Choctawhatchee, Perdido Key, St. Andrew)	*Peromyscus polionotus*		--		Alabama and Florida (Panhandle) beaches

Abbreviations: E = Endangered; T = Threatened; NWR = National Wildlife Refuge.

[a] The blue, fin, humpback, North Atlantic right, and sei whales are rare or extralimital in the Gulf of Mexico and are unlikely to be present in the lease area.

[b] The green sea turtle is threatened, except for the Florida breeding population, which is listed as endangered.

The sperm whale and five species of sea turtles are the only endangered or threatened species likely to occur at or near the lease area. No critical habitat has been designated for these species in the Gulf of Mexico.

Five endangered mysticete whales (blue whale, fin whale, humpback whale, North Atlantic right whale, and sei whale) also have been reported from the Gulf of Mexico but are considered rare or extralimital there (Würsig et al., 2000). No critical habitat has been designated for these species in the Gulf of Mexico.

Coastal endangered or threatened species include the Florida manatee, Piping Plover, Whooping Crane, Gulf sturgeon, and four subspecies of beach mice. Critical habitat has been designated for all of these species as indicated in the table and discussed in individual sections.

Two other coastal species (Bald Eagle and Brown Pelican) discussed by MMS (2007b) are no longer listed as endangered or threatened; these are discussed under Coastal and Marine Birds.

There are no other endangered animals or plants in the Gulf of Mexico that are reasonably likely to be affected by either routine or accidental events. Other species occurring at certain locations in the Gulf of Mexico such as the smalltooth sawfish (*Pristis pectinata*), elkhorn coral (*Acropora palmata*), staghorn coral (*Acropora cervicornis*), and Florida salt marsh vole (*Microtus pennsylvanicus dukecampbelli*) are remote from the lease area and highly unlikely to be affected.

C.3.1 Sperm Whale (Endangered)

The only endangered marine mammal likely to be present at or near the project area is the sperm whale (*Physeter macrocephalus*). Resident populations of sperm whales occur within the Gulf of Mexico. A species description is presented in a recent lease sale EIS (MMS, 2007b). Gulf of Mexico sperm whales are classified as an endangered species and a "strategic stock" (defined as a stock that may have unsustainable human-caused impacts) by NOAA Fisheries (Waring et al. 2009). No critical habitat for sperm whales has been designated in the Gulf of Mexico.

The distribution of sperm whales in the Gulf of Mexico is correlated with mesoscale physical features such as eddies associated with the Gulf of Mexico Loop Current (Jochens et al., 2008). Sperm whale populations in the north-central Gulf of Mexico are present there throughout the year (Davis et al., 2000). Results of a multi-year tracking study show female sperm whales typically concentrated along the upper continental slope between the 200- and 1,000-m (656- and 3,280-ft) depth contours (Jochens et al., 2008). Male sperm whales were more variable in their movements and were documented in water depths greater than 3,000 m (9,843 ft). Generally, groups of sperm whales sighted in the Gulf of Mexico during the MMS-funded Sperm Whale Seismic Study (SWSS) consisted of mixed-sex groups comprising adult females and immatures, and groups of bachelor males. Typical group size for mixed groups was 10 individuals (Jochens et al., 2008). SWSS results show that sperm whales transit through the vicinity of the lease area. Movements of satellite-tracked individuals suggest that this area of the Gulf continental slope is within the home range of the Gulf of Mexico population (Jochens et al., 2008).

IPFs potentially affecting sperm whales include drilling rig presence, noise, and lights; support vessel and helicopter traffic; and two types of accidents – a small fuel spill and a large oil spill (WCD). Effluent discharges are likely to have negligible impacts on sperm whales due to rapid dispersion, the small area of ocean affected, the intermittent nature of the discharges, and the mobility of these marine mammals. Compliance with NTL 2007-G03 will minimize the potential for marine debris-related impacts on sperm whales.

Impacts of Drilling Rig Presence, Noise, and Lights

Noise from routine drilling activities has the potential to disturb sperm whales. Sperm whales appear to have good low-frequency hearing, but the available data do not indicate a consistent response to anthropogenic noise (Jochens et al., 2008). Noise associated with drilling is relatively weak in intensity, and an individual animal's noise exposure would be transient. There are other OCS facilities and activities near the lease area (e.g., Shell's Auger tension-leg platform), and the region as a whole has a large number of similar sources. Due to the limited scope and short duration of drilling activities, this project would represent a small temporary contribution to the overall noise regime.

The NMFS (2007) analyzed the potential for impacts of drilling-related noise on sperm whales in its Biological Opinion for the Five-Year Oil and Gas Leasing Program in the Central and Western Gulf of Mexico Planning Areas. The analysis noted that semisubmersible drilling rigs show low sound source levels and concluded that drilling is not expected to produce amplitudes sufficient to cause hearing or behavioral effects in sperm whales; therefore, these effects are insignificant (NMFS, 2007).

Drilling rig lighting and rig presence are not identified as IPFs for sperm whales in recent lease sale EISs (MMS, 2007b, 2008) or the NMFS (2007) Biological Opinion.

Impacts of Support Vessel and Helicopter Traffic

Support vessel traffic has the potential to disturb sperm whales and there is also a risk of vessel strikes, which are identified as a threat in the recovery plan for this species (NMFS, 2006). Data concerning the frequency of vessel strikes is presented in the lease sale EIS (MMS, 2007b). To reduce the potential for vessel strikes, the BOEMRE has issued NTL 2007-G04, which recommends protected species identification training and that vessel operators and crews maintain a vigilant watch for marine mammals and slow down or stop their vessel to avoid striking protected species, and requires operators to report sightings of any injured or dead protected species. When whales are sighted, vessel operators and crews are required to attempt to maintain a distance of 91 m (300 ft) or greater whenever possible. Vessel operators are required to reduce vessel speed to 10 knots or less when mother/calf pairs, pods, or large assemblages of cetaceans are observed near an underway vessel when safety permits. Compliance with this NTL will minimize the likelihood of vessel strikes as well as reduce the chance for disturbing sperm whales.

The NMFS (2007) analyzed the potential for vessel strikes and harassment of sperm whales in its Biological Opinion for the Five-Year Oil and Gas Leasing Program in the Central and Western Planning Areas of the Gulf of Mexico. With implementation of the mitigation measures in NTL 2007-G04, NMFS concluded that the likelihood of collisions between vessels and sperm whales would be reduced to insignificant levels. The NMFS concluded that the observed avoidance of passing vessels by sperm whales is an advantageous response to avoid a potential threat and is not expected to result in any significant effect on migration, breathing, nursing, breeding, feeding, or sheltering to individuals, or have any consequences at the level of the population. With implementation of the vessel strike avoidance measures requirement to maintain a distance of 90 m (295 ft) from sperm whales, the NMFS concluded that the potential for harassment of sperm whales would be reduced to discountable levels.

Helicopter traffic also has the potential to disturb sperm whales. Smultea et al. (2008) documented responses of sperm whales offshore Hawaii to fixed wing aircraft flying at an altitude of 245 m (800 ft). A reaction to the initial pass of the aircraft was observed during three (12%) of 24 sightings. All three reactions consisted of a hasty dive and occurred at less than 360 m (1,180 ft) lateral distance from the aircraft. Additional reactions were seen when aircraft circled certain whales to make further observations. Based on other studies of cetacean responses to sound, the authors concluded that the observed reactions to brief overflights by the aircraft were short term and probably of no long-term biological significance.

While flying offshore in the Gulf of Mexico, helicopters maintain altitudes above 213 m (700 ft) during transit to and from the working area. In the event that a whale is seen during transit, the helicopter will not approach or circle the animals. Although responses are possible based on the Smultea et al. (2008) study, the NMFS (2007) concluded that this altitude would minimize the potential for disturbing sperm whales. Therefore, no significant impacts are expected.

Impacts of a Small Fuel Spill

Potential spill impacts on marine mammals including sperm whales are discussed in recent EISs (MMS, 2007b, 2008) and by the NMFS (2007) in its Biological Opinion for the Five-Year Oil and Gas Leasing Program in the Central and Western Planning Areas of the Gulf of Mexico. Oil impacts on marine mammals are discussed by Geraci and St. Aubin (1990). For this RDOCD, there are no unique site-specific issues with respect to spill impacts on these animals.

The probability of a fuel spill will be minimized by Shell's preventative measures during routine operations including fuel transfer. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the potential for impacts on sperm whales. **RDOCD Sections 2j** and **9b** provide detail on spill response measures. Given the open ocean location of the lease area, the duration of a small spill and opportunity for impacts to occur would be very brief.

A small fuel spill in offshore waters would produce a slick on the water surface and increase the concentrations of petroleum hydrocarbons and their degradation products. The extent and persistence of impacts would depend on the meteorological and oceanographic conditions at the time and the effectiveness of spill response measures. **Section A.9.2** discusses the likely fate of a small fuel spill and indicates that over 90% would be evaporated or dispersed naturally within 24 hours. The area of the sea surface with diesel fuel on it would range from 0.5 to 5 ha (1.2 to 12 ac) depending on sea state and weather conditions.

Direct physical and physiological effects of exposure to diesel fuel could include skin irritation, inflammation, or necrosis; chemical burns of skin, eyes, and mucous membranes; inhalation of toxic fumes; ingestion of oil directly or via contaminated prey; and stress from the activities and noise of response vessels and aircraft (Marine Mammal Commission [MMC], 2010). However, due to the limited areal extent and short duration of water quality impacts from a small fuel spill, as well as the mobility of sperm whales, no significant impacts would be expected.

Impacts of a Large Oil Spill (WCD)

Potential spill impacts on marine mammals including sperm whales are discussed in recent EISs (MMS, 2007b, 2008) and by the NMFS (2007) in its Biological Opinion for the Five-Year Oil and Gas Leasing Program in the Central and Western Planning Areas of the Gulf of Mexico. Oil impacts on marine mammals are discussed by Geraci and St. Aubin (1990). For this RDOCD, there are no unique site-specific issues with respect to spill impacts on these animals.

Impacts of oil spills on sperm whales can include direct impacts from oil exposure, as well as indirect impacts due to response activities and materials (e.g., vessel traffic, noise, and dispersants) (MMC, 2010). Direct physical and physiological effects can include skin irritation, inflammation, or necrosis; chemical burns of skin, eyes, and mucous membranes; inhalation of toxic fumes; ingestion of oil (and dispersants) directly or via contaminated prey; and stress from the activities and noise of response vessels and aircraft. Complications of the above may lead to dysfunction of immune and reproductive systems, physiological stress, declining physical condition, and death. Behavioral responses can include displacement of animals from prime habitat; disruption of social structure; changing prey availability and foraging distribution and/or patterns; changing reproductive behavior/productivity; and changing movement patterns or migration (MMC, 2010).

In the event of a large spill, the level of vessel and aircraft activity associated with spill response could disturb sperm whales and potentially result in vessel strikes, entanglement, or other injury or stress. Response vessels would operate in accordance with NTL 2007-G04 to reduce the potential for striking or disturbing these animals.

A blowout resulting in a large oil spill (WCD) is an extremely rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in **RDOCD Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **RDOCD Sections 2j** and **9b** provide detail on spill response measures. Therefore, no significant spill impacts on sperm whales are expected.

C.3.2 Florida Manatee (Endangered)

The endangered Florida manatee is a coastal species that does not occur in the project area. Sightings in Texas coastal waters are rare enough to be newsworthy (Houston Chronicle, 2010), and most of the manatee population is located in peninsular Florida (USFWS, 2001). A species description is presented in a recent lease sale EIS (MMS, 2007b) and in the recovery plan for this species (USFWS, 2001).

IPFs potentially affecting manatees include support vessel and helicopter traffic and a large oil spill (WCD). A small fuel spill in the lease area would be unlikely to affect manatees, as the lease area is 142 miles (229 km) from the nearest shoreline (Texas). As explained in **Section A.9.2**, a small fuel spill would not be expected to make landfall or reach coastal waters prior to breaking up. Compliance with NTL 2007-G03 will minimize the potential for marine debris-related impacts on manatees.

Impacts of Support Vessel and Helicopter Traffic

Support vessel traffic has the potential to disturb manatees and there is also a risk of vessel strikes, which are identified as a threat in the recovery plan for this species (USFWS, 2001). However, because manatees rarely occur in Texas coastal waters, impacts are unlikely. To reduce the potential for vessel strikes, the BOEMRE has issued NTL 2007-G04, which recommends protected species identification training and that vessel operators and crews maintain a vigilant watch for marine mammals and slow down or stop their vessel to avoid striking protected species and requires operators to report sightings of any injured or dead protected species. Compliance with this NTL will minimize the likelihood of vessel strikes, and no significant impacts on manatees are expected.

Helicopter traffic also has the potential to disturb manatees, if any are present. Rathbun (1988) reported that manatees were disturbed more by helicopters than by fixed-wing aircraft; however, the helicopter was flown at a relatively low altitude of 20 to 160 m (66 to 525 ft). Helicopters used in support operations maintain a minimum altitude of 213 m (700 ft) while in transit offshore, 305 m (1,000 ft) over unpopulated areas or across coastlines, and 610 m (2,000 ft) over populated areas and sensitive habitats such as wildlife refuges and park properties. This mitigation measure will minimize the potential for disturbing manatees, and no significant impacts are expected.

Impacts of a Large Oil Spill (WCD)

The OSRA results summarized in **Table 3** predict that some Texas and Louisiana shorelines could be contacted by a spill within 30 days. There is no critical habitat designated in these areas, and the number of manatees potentially present is a small fraction of the population in peninsular Florida.

In the event that manatees were exposed to oil, effects could include direct impacts from oil exposure, as well as indirect impacts due to response activities and materials (e.g., vessel traffic, noise, and dispersants) (MMC, 2010). Direct physical and physiological effects can include skin irritation, inflammation, or necrosis; chemical burns of skin, eyes, and mucous membranes; inhalation of toxic fumes; ingestion of oil (and dispersants) directly or via contaminated prey (or contaminated vegetation, in the case of manatees); and stress from the activities and noise of response vessels and aircraft. Complications of the above may lead to dysfunction of immune and reproductive systems, physiological stress, declining physical condition, and death. Behavioral responses can include displacement of animals from prime habitat; disruption of social structure; changing prey availability and foraging distribution and/or patterns; changing reproductive behavior/productivity; and changing movement patterns or migration (MMC, 2010).

In the event that a large spill reached coastal waters where manatees were present, the level of vessel and aircraft activity associated with spill response could disturb manatees and potentially result in vessel strikes, entanglement, or other injury or stress. Response vessels would operate in accordance with NTL 2007-G04 to reduce the potential for striking or disturbing these animals, and therefore no significant impacts are expected.

A blowout resulting in a large oil spill (WCD) is an extremely rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in **RDOCD Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **RDOCD Sections 2j** and **9b** provide detail on spill response measures. Therefore, no significant spill impacts on manatees are expected.

C.3.3 Endangered Mysticete Whales

Five endangered mysticete whales (blue whale, fin whale, humpback whale, North Atlantic right whale, and sei whale) also have been reported from the Gulf of Mexico but are considered rare or extralimital there (Würsig et al., 2000). No critical habitat has been designated for these species in the Gulf of Mexico.

Due to the rare occurrence of these whales in the Gulf of Mexico and the limited scope and duration of the project, it is highly unlikely that any endangered mysticete whale would come into contact with any project activities, either routine operations or accidents. The NMFS (2007) did not include any of these mysticete whales as affected species in its Biological Opinion for the Five-Year Oil and Gas Leasing Program in the Central and Western Planning Areas of the Gulf of Mexico. Potential impacts are analyzed in recent lease sale EISs (MMS, 2007b, 2008) and those analyses are incorporated by reference. If any of these whales were present in the area, potential impacts would be the same as those discussed below in **Section C.3.4**.

C.3.4 Non-Endangered Marine Mammals (Protected)

Excluding the seven endangered species that have been cited previously, there are 22 additional species of marine mammals that may be found in the Gulf of Mexico (see **DOCD Section 6h**). All marine mammals are protected species under the MMPA. This includes two mysticete whales, the dwarf and pygmy sperm whales, 4 species of beaked whales, and 14 species of dolphins and porpoises. The most common non-endangered cetaceans in the deepwater environment are odontocetes such as the pantropical spotted dolphin, spinner dolphin, and clymene dolphin. A brief summary is presented below and additional information on these groups is presented in a recent lease sale EIS (MMS, 2007b).

<u>Mysticete whales</u>. Two non-endangered mysticete whales are known from the Gulf of Mexico. The Bryde's whale (*Balaenoptera edeni*) has been sighted most frequently along the 100-m (328-ft) isobath (Davis and Fargion, 1996; Davis et al., 2000). Most sightings have been made in the DeSoto Canyon region and off western Florida, although there have been some in the west-central portion of the northeastern Gulf. The minke whale (*Balaenoptera acutorostrata*) is considered rare in the Gulf of Mexico, with the only confirmed records coming from strandings (Würsig et al., 2000). Based on the available data, neither species is likely to be present in the lease area.

<u>Dwarf and pygmy sperm whales</u>. At sea, it is difficult to differentiate dwarf sperm whales (*Kogia sima*) from pygmy sperm whales (*Kogia breviceps*), and sightings are often grouped together as "*Kogia* spp." Both species have a worldwide distribution in temperate to tropical waters. In the Gulf of Mexico, both species occur primarily along the continental shelf edge and in deeper waters off the continental shelf (Mullin et al., 1991). Either species could occur in the lease area.

<u>Beaked whales</u>. Four species of beaked whales are known from the Gulf of Mexico. They are Blainville's beaked whale (*Mesoplodon densirostris*), Cuvier's beaked whale (*Ziphius cavirostris*), Sowerby's beaked whale (*Mesoplodon bidens*), and Gervais' beaked whale (*Mesoplodon europaeus*). Stranding records in the Gulf of Mexico suggest that Gervais' beaked whale is the most common and Sowerby's is extralimital. Due to the difficulties of at-sea identification, beaked whales in the Gulf of Mexico are identified either as Cuvier's beaked whales or are grouped into an undifferentiated complex (*Mesoplodon* spp. and *Ziphius* spp.). In the northern Gulf of Mexico, they are broadly distributed in waters greater than 1,000 m (3,281 ft) over lower slope and abyssal landscapes (Davis et al., 2000). Any of these species could occur in the lease area.

<u>Dolphins and porpoises</u>. Fourteen species of dolphins and porpoises are known from the Gulf of Mexico, including Atlantic spotted dolphin (*Stenella frontalis*), bottlenose dolphin (*Tursiops truncatus*), clymene dolphin (*Stenella clymene*), false killer whale (*Pseudorca crassidens*), Fraser's dolphin (*Lagenodelphis hosei*), killer whale (*Orcinus orca*), melon-headed whale (*Peponocephala electra*), pantropical spotted dolphin (*Stenella attenuata*), pygmy killer whale (*Feresa attenuata*), short-finned pilot whale (*Globicephala macrorhynchus*), Risso's dolphin (*Grampus griseus*), rough-toothed dolphin (*Steno bredanensis*), spinner dolphin (*Stenella longirostris*), and striped dolphin (*Stenella coeruleoalba*). The most common non-endangered cetaceans in the deepwater

environment are the pantropical spotted dolphin, spinner dolphin, and clymene dolphin. However, any of these species could occur in the lease area.

IPFs potentially affecting non-endangered marine mammals include drilling rig presence, noise, and lights; support vessel and helicopter traffic; and two types of accidents (a small fuel spill and a large oil spill represented by the WCD for this RDOCD). Effluent discharges are likely to have negligible impacts on marine mammals due to rapid dispersion, the small area of ocean affected, the intermittent nature of the discharges, and the mobility of marine mammals. Compliance with NTL 2007-G03 will minimize the potential for marine debris-related impacts on marine mammals.

Impacts of Drilling Rig Presence, Noise, and Lights

Noise from routine drilling activities has the potential to disturb marine mammals. Most odontocetes (toothed whales and dolphins) use sounds that are higher than the low-frequency dominant frequencies produced by OCS drilling activities (Richardson et al., 1995). Noise associated with drilling is relatively weak in intensity, and an individual animal's noise exposure would be transient. There are other OCS facilities and activities near the lease area (e.g., Shell's Auger tension-leg platform), and the region as a whole has a large number of similar sources. Due to the limited scope and short duration of drilling activities, this project would represent a small temporary contribution to the overall noise regime and any short-term impacts are not expected to be biologically significant to marine mammal populations.

Drilling rig lighting and rig presence are not identified as IPFs for marine mammals in recent lease sale EISs (MMS, 2007b, 2008).

Impacts of Support Vessel and Helicopter Traffic

Support vessel traffic has the potential to disturb marine mammals and there is also a risk of vessel strikes. Data concerning the frequency of vessel strikes is presented in the lease sale EIS (MMS, 2007b). To reduce the potential for vessel strikes, the BOEMRE has issued NTL 2007-G04, which recommends protected species identification training and that vessel operators and crews maintain a vigilant watch for marine mammals and slow down or stop their vessel to avoid striking protected species, and requires operators to report sightings of any injured or dead protected species. Vessel operators and crews are required to attempt to maintain a distance of 91 m (300 ft) or greater when whales are sighted and 45 m (150 ft) when small cetaceans are sighted. When cetaceans are sighted while a vessel is underway, vessels must attempt to remain parallel to the animal's course and avoid excessive speed or abrupt changes in direction until the cetacean has left the area. Vessel operators are required to reduce vessel speed to 10 knots or less when mother/calf pairs, pods, or large assemblages of cetaceans are observed near an underway vessel when safety permits. Compliance with this NTL will minimize the likelihood of vessel strikes as well as reduce the chance for disturbing marine mammals and therefore no significant impacts are expected.

Aircraft traffic also has the potential to disturb marine mammals (Würsig et al., 1998). However, while flying offshore, helicopters maintain altitudes above 213 m (700 ft) during transit to and from the working area. This altitude will minimize the potential for disturbing marine mammals, and no significant impacts are expected (MMS, 2007b).

Impacts of a Small Fuel Spill

Potential spill impacts on marine mammals are discussed in recent EISs (MMS, 2007b, 2008) and oil impacts on marine mammals in general are discussed by Geraci and St. Aubin (1990). For this RDOCD, there are no unique site-specific issues with respect to spill impacts on these animals.

The probability of a fuel spill will be minimized by Shell's preventative measures during fuel transfer. In the unlikely event of a spill, implementation of Shell's OSRP is expected to mitigate and reduce the potential for impacts on marine mammals. **RDOCD Sections 2j** and **9b** provide detail on spill response measures. Given the open ocean location of the lease area, the duration of a small spill and opportunity for impacts to occur would be very brief.

A small fuel spill in offshore waters would produce a slick on the water surface and increase the concentrations of petroleum hydrocarbons and their degradation products. The extent and persistence of impacts would depend on the meteorological and oceanographic conditions at the time and the effectiveness of spill response measures. **Section A.9.2** discusses the likely fate of a small fuel spill and indicates that over 90% would be evaporated or dispersed naturally within 24 hours. The area of the sea surface with diesel fuel on it would range from 0.5 to 5 ha (1.2 to 12 ac) depending on sea state and weather conditions.

Direct physical and physiological effects of exposure to diesel fuel could include skin irritation, inflammation, or necrosis; chemical burns of skin, eyes, and mucous membranes; inhalation of toxic fumes; ingestion of oil directly or via contaminated prey; and stress from the activities and noise of response vessels and aircraft (MMC, 2010). However, due to the limited areal extent and short duration of water quality impacts from a small fuel spill, as well as the mobility of marine mammals, no significant impacts would be expected.

Impacts of a Large Oil Spill (WCD)

Potential spill impacts on marine mammals are discussed in recent EISs (MMS, 2007b, 2008) and by Geraci and St. Aubin (1990). For this RDOCD, there are no unique site-specific issues.

Impacts of oil spills on marine mammals can include direct impacts from oil exposure, as well as indirect impacts due to response activities and materials (e.g., vessel traffic, noise, and dispersants) (MMC, 2010). Direct physical and physiological effects can include skin irritation, inflammation, or necrosis; chemical burns of skin, eyes, and mucous membranes; inhalation of toxic fumes; ingestion of oil (and dispersants) directly or via contaminated prey (or contaminated vegetation, in the case of manatees); and stress from the activities and noise of response vessels and aircraft. Complications of the above may lead to dysfunction of immune and reproductive systems, physiological stress, declining physical condition, and death. Behavioral responses can include displacement of animals from prime habitat; disruption of social structure; changing prey availability and foraging distribution and/or patterns; changing reproductive behavior/productivity; and changing movement patterns or migration (MMC, 2010).

In the event of a large spill, the level of vessel and aircraft activity associated with spill response could disturb marine mammals and potentially result in vessel strikes, entanglement, or other injury or stress. Response vessels would operate in accordance with NTL 2007-G04 to reduce the potential for striking or disturbing these animals and therefore no significant impacts are expected.

A blowout resulting in a large oil spill (WCD) is an extremely rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in **RDOCD Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **RDOCD Sections 2j** and **9b** provide detail on spill response measures. Therefore, no significant spill impacts on marine mammals are expected.

C.3.5 Sea Turtles (Endangered/Threatened)

As listed in **RDOCD Section 6h**, five species of endangered or threatened sea turtles may be found near the lease area. Endangered species are the leatherback (*Dermochelys coriacea*), Kemp's ridley (*Lepidochelys kempii*), and hawksbill (*Eretmochelys imbricata*) turtles. The loggerhead turtle (*Caretta caretta*) is a threatened species. The green turtle (*Chelonia mydas*) is listed as threatened, except for the Florida breeding population, which is listed as endangered. Species descriptions are presented in a recent lease sale EIS (MMS, 2007b).

Leatherbacks and loggerheads are the most likely species to be present near the lease area as adults. Green, hawksbill, and Kemp's ridley turtles are typically inner shelf and nearshore species, unlikely to occur near the lease area as adults. Hatchlings or juveniles of any of the sea turtles may be present in deepwater areas, including the lease area, where they may be associated with *Sargassum* and other flotsam.

Significant sea turtle nesting occurs along the south Texas coast. Padre Island National Seashore, located approximately 145 miles (233 km) west-northwest from the lease area, is considered an important secondary nesting colony for Kemp's ridley turtles; during the last 50 years, more confirmed Kemp's ridley nests have been located there than at any other location in the U.S. (NMFS et al., 2010). The main nesting site of the Kemp's ridley turtle is Rancho Nuevo beach, Tamaulipas, Mexico, about 275 miles (440 km) southwest of the lease area (NMFS et al., 2010). The location of Kemp's ridley nesting areas is shown in **Figure 4**.

South Texas inshore waters also provide important habitat for juvenile green sea turtles, and Padre Island National Seashore and South Padre Island are the only locations on the Texas coast where green turtle nesting has been documented (NPS, 2010b).

Other turtle nesting in the area is limited. Loggerhead and leatherback turtles occasionally nest on Texas beaches, but the main U.S. nesting sites are elsewhere (e.g., in Florida). Hawksbill turtles normally do not nest anywhere near the lease area.

IPFs potentially affecting sea turtles include drilling rig presence, noise, and lights; support vessel and helicopter traffic; and two types of accidents (a small fuel spill and a large oil spill represented by the WCD for this RDOCD). Effluent discharges are likely to have negligible impacts on sea turtles due to rapid dispersion, the small area of ocean affected, and the intermittent nature of the discharges. Compliance with NTL 2007-G03 will minimize the potential for marine debris-related impacts on sea turtles.

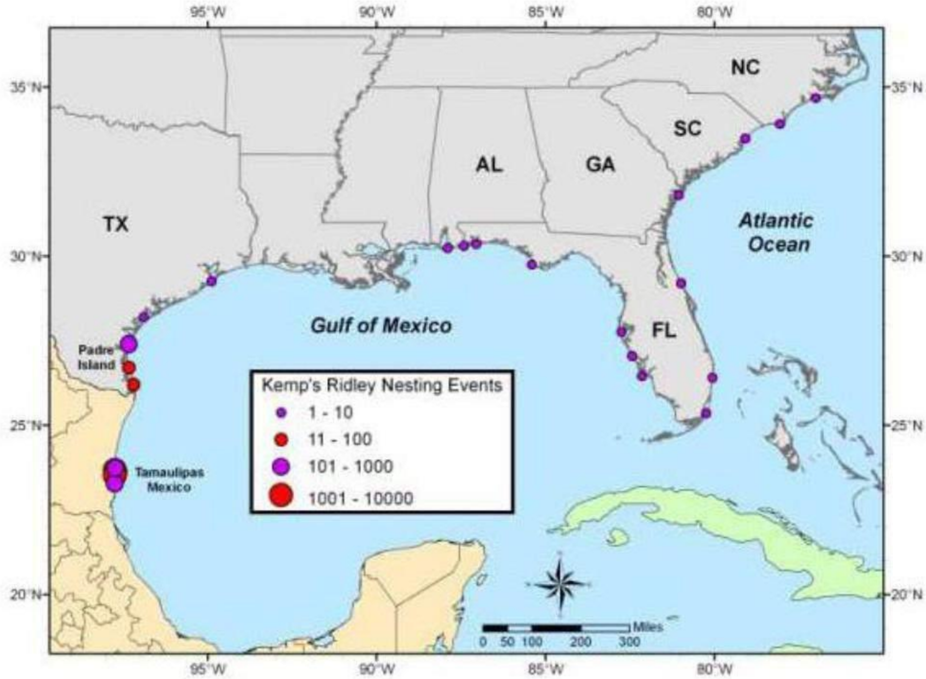

Figure 4. Kemp's ridley sea turtle nesting sites in the region.

Impacts of Drilling Rig Presence, Noise, and Lights

Offshore drilling activities produce a broad array of sounds at frequencies and intensities that may be detected by sea turtles (Geraci and St. Aubin, 1987). Potential impacts may include behavioral disruption and temporary or permanent displacement from the area near the sound source. Certain sea turtles, especially loggerheads, may be attracted to offshore structures (Lohoefener et al., 1990) and, thus, may be more susceptible to impacts from sounds produced during routine operations. Helicopters and service vessels may also affect sea turtles due to machinery noise and/or visual disturbances. The most likely impacts would be short-term behavioral changes such as diving and evasive swimming, disruption of activities, or departure from the area. Due to the limited scope and short duration of drilling activities, these short-term impacts are not expected to be biologically significant to sea turtle populations.

Artificial lighting can disrupt the nocturnal orientation of sea turtle hatchlings (Witherington, 1997; Tuxbury and Salmon, 2005). However, hatchlings may rely less on light cues when they are offshore than when they are emerging on the beach (Salmon and Wyneken, 1990). The NMFS (2007) concluded that the effects of lighting from offshore structures on sea turtles are insignificant.

Support Vessel and Helicopter Traffic

Support vessel traffic has the potential to disturb sea turtles and there is also a risk of vessel strikes. Data show that vessel traffic is one cause of sea turtle mortality in the Gulf of Mexico (Lutcavage et al., 1997). While adult sea turtles are visible at the surface during the day and in clear weather, they can be difficult to spot from a moving vessel when resting below the water surface, during nighttime, or during periods of inclement weather. To reduce the potential for vessel strikes, the BOEMRE has issued NTL 2007-G04, which recommends protected species identification training and that vessel operators and crews maintain a vigilant watch for sea turtles and slow down or stop their vessel to avoid striking protected species, and requires operators to report sightings of any injured or dead protected species. When sea turtles are sighted, vessel operators and crews are required to attempt to maintain a distance of 45 m (150 ft) or greater whenever possible. Compliance with this NTL will minimize the likelihood of vessel strikes as well as reduce the chance for disturbing sea turtles (NMFS, 2007).

Helicopter traffic also has the potential to disturb sea turtles. However, while flying offshore, helicopters maintain altitudes above 213 m (700 ft) during transit to and from the working area. This altitude will minimize the potential for disturbing sea turtles, and no significant impacts are expected.

Impacts of a Small Fuel Spill

Potential spill impacts on sea turtles are discussed in recent EISs (MMS, 2007b, 2008) and by the NMFS (2007) in its Biological Opinion for the Five-Year Oil and Gas Leasing Program in the Central and Western Planning Areas of the Gulf of Mexico. For this RDOCD, there are no unique site-specific issues with respect to spill impacts on these animals.

The probability of a fuel spill will be minimized by Shell's preventative measures during fuel transfer. In the unlikely event of a spill, implementation of Shell's OSRP is expected to mitigate and reduce the potential for impacts on sea turtles. **RDOCD Sections 2j** and **9b** provide detail on spill response measures. Given the open ocean location of the lease area, the duration of a small spill and opportunity for impacts to occur would be very brief.

A small fuel spill in offshore waters would produce a slick on the water surface and increase the concentrations of petroleum hydrocarbons and their degradation products. The extent and persistence of impacts would depend on the meteorological and oceanographic conditions at the time and the effectiveness of spill response measures. **Section A.9.2** discusses the likely fate of a small fuel spill and indicates that over 90% would be evaporated or dispersed naturally within 24 hours. The area of the sea surface with diesel fuel on it would range from 0.5 to 5 ha (1.2 to 12 ac) depending on sea state and weather conditions.

Direct physical and physiological effects of exposure to diesel fuel could include skin irritation, inflammation, or necrosis; chemical burns of skin, eyes, and mucous membranes; inhalation of toxic fumes; ingestion of oil directly or via contaminated prey; and stress from the activities and noise of response vessels and aircraft (MMC, 2010). However, due to the limited areal extent and short duration of water quality impacts from a small fuel spill, no significant impacts would be expected.

A small fuel spill in the lease area would be unlikely to affect sea turtle nesting beaches, as the lease area is 142 miles (229 km) from the nearest shoreline (Texas). As explained in **Section A.9.2**, a small fuel spill would not be expected to make landfall or reach coastal waters prior to breaking up.

Impacts of a Large Oil Spill (WCD)

Impacts of oil spills on sea turtles can include direct impacts from oil exposure, as well as indirect impacts due to response activities and materials (e.g., vessel traffic, noise, and dispersants). Direct physical and physiological effects can include skin irritation, inflammation, or necrosis;

chemical burns of skin, eyes, and mucous membranes; inhalation of toxic fumes and smoke (e.g., from *in situ* burning of oil); ingestion of oil (and dispersants) directly or via contaminated food; and stress from the activities and noise of response vessels and aircraft. Complications of the above may lead to dysfunction of immune and reproductive systems, physiological stress, declining physical condition, and death. Behavioral responses can include displacement of animals from prime habitat; disruption of social structure; changing food availability and foraging distribution and/or patterns; changing reproductive behavior/productivity; and changing movement patterns or migration (MMC, 2010). In the unlikely event of a spill, implementation of Shell's OSRP is expected to mitigate and reduce the potential for these types of impacts on sea turtles. **RDOCD Sections 2j** and **9b** provide detail on spill response measures.

Studies of oil effects on loggerheads in a controlled setting (Lutcavage et al., 1995) suggest that sea turtles show no avoidance behavior when they encounter an oil slick and any sea turtle in an affected area would be expected to be exposed. Sea turtles' diving behaviors also put them at risk. Sea turtles rapidly inhale a large volume of air before diving and continually resurface over time, which may result in repeated exposure to volatile vapors and oiling (NMFS, 2007).

The OSRA results summarized in **Table 3** predict that some Texas and Louisiana shorelines that support sea turtle nesting could be contacted within 30 days. The modeling predicts a 4% probability within 30 days of contacting the Padre Island National Seashore, which supports Kemp's ridley nesting. The model does not predict any shoreline contacts within 30 days in Alabama or the Florida Panhandle, which supports significant loggerhead turtle nesting. The modeling does not indicate whether other shorelines could be contacted in the event of a spill persisting for more than 30 days.

Spilled oil reaching sea turtle nesting beaches could have affects on nesting sea turtles and egg development (NMFS, 2007). An oiled beach could affect nest site selection or result in no nesting at all (e.g., false crawls). Upon hatching and successfully reaching the water, hatchlings are subject to the same types of oil spill exposure hazards as adults. Hatchlings that contact oil residues while crossing a beach can exhibit a range of effects, from acute toxicity to impaired movement and normal bodily functions (NMFS, 2007).

In the event of a large spill, the level of vessel and aircraft activity associated with spill response could disturb sea turtles and potentially result in vessel strikes, entanglement, or other injury or stress. Response vessels would operate in accordance with NTL 2007-G04 to reduce the potential for striking or disturbing these animals and therefore no significant impacts are expected.

A blowout resulting in a large oil spill (WCD) is an extremely rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in **RDOCD Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **RDOCD Sections 2j** and **9b** provide detail on spill response measures. Therefore, no significant spill impacts on sea turtles are expected.

C.3.6 Piping Plover (Threatened)

The Piping Plover (*Charadrius melodus*) is a migratory shore bird that overwinters along the southeastern U.S. and Gulf of Mexico coasts. This threatened species is in decline as a result of hunting, habitat loss and modification, predation, and disease (USFWS, 2003). Critical overwintering habitat has been designated, including beaches in Texas, Louisiana, Mississippi, Alabama, and Florida (**Figure 5**). Piping Plovers inhabit coastal sandy beaches and mudflats, feeding by probing for invertebrates at or just below the surface. They use beaches adjacent to foraging areas for roosting and preening (USFWS, 2010a). A species description is presented in a recent lease sale EIS (MMS, 2007b).

A large oil spill (WCD) is the only IPF potentially affecting Piping Plovers. There are no IPFs associated with routine project activities that could affect these birds. A small fuel spill in the lease area would be unlikely to affect Piping Plovers, as the lease area is 142 miles (229 km) from the nearest shoreline inhabited by these birds. As explained in **Section A.9.2**, a small fuel spill would not be expected to make landfall or reach coastal waters prior to breaking up.

Impacts of a Large Oil Spill (WCD)

The OSRA results summarized in **Table 3** predict that Texas and Louisiana shorelines could be contacted by a spill within 30 days. These shorelines include designated critical habitat for the wintering Piping Plover. Brazos Island State Park at the Texas/Mexico border, which is the nearest shoreline to the lease area, includes Piping Plover critical habitat.

Plovers could physically oil themselves while foraging on oiled shores or secondarily contaminate themselves through ingestion of oiled intertidal sediments and prey (MMS, 2007b). Plovers congregate and feed along tidally exposed banks and shorelines, following the tide out and foraging at the water's edge. It is possible that some deaths of Piping Plovers could occur, especially if spills occur during winter months when plovers are most common along the coastal Gulf or if spills contacted critical habitat. Impacts could also occur from vehicular traffic on beaches and other activities associated with spill cleanup. Shell has extensive resources available to protect and rehabilitate wildlife in the event of a spill reaching the shoreline, as detailed in the OSRP.

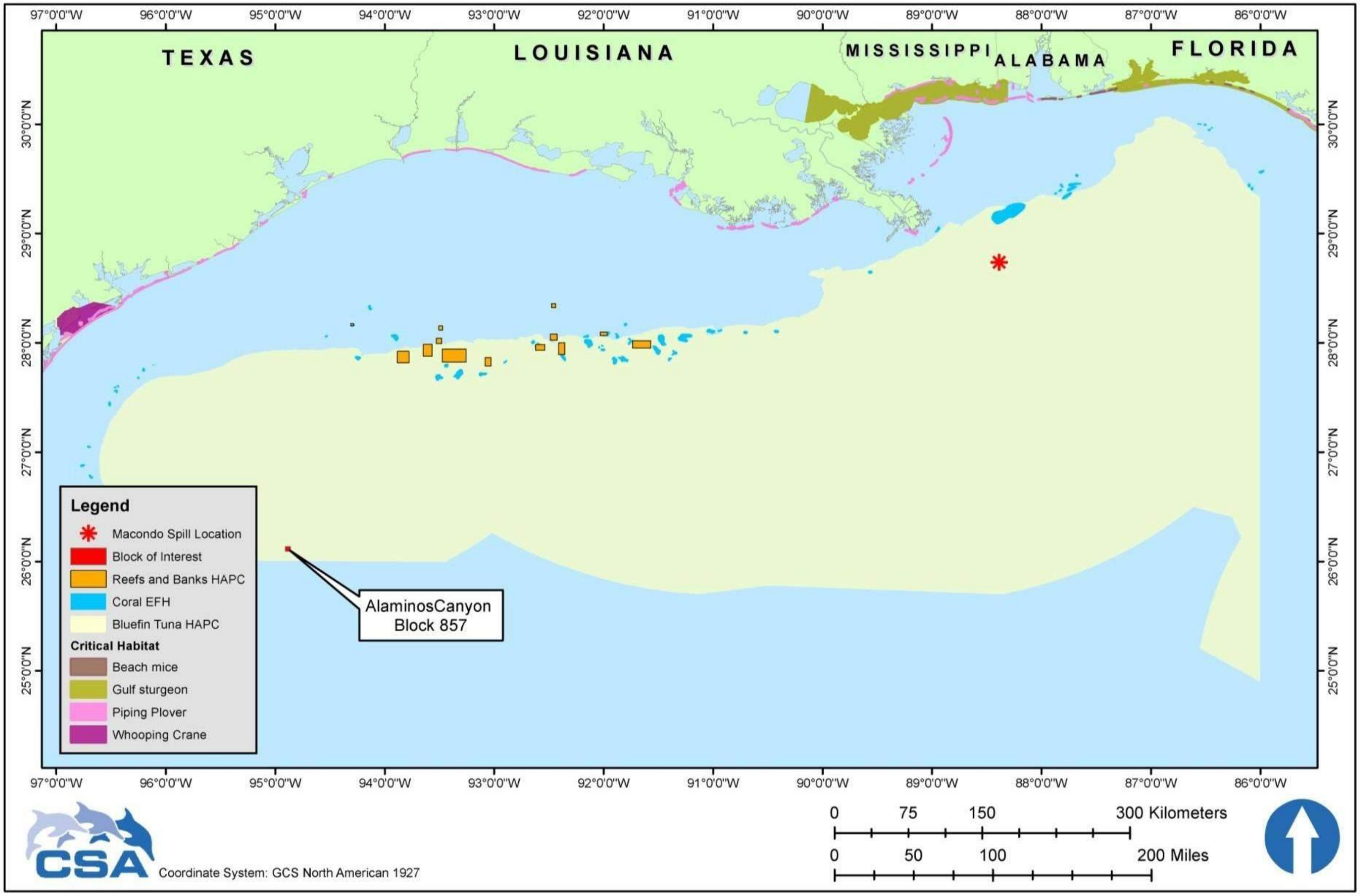

Figure 5. Location of selected environmental features in relation to the lease area. Shown are Essential Fish Habitat (EFH) for coral and coral reefs; Habitat Areas of Particular Concern (HAPCs) for northwestern Gulf of Mexico reefs and banks and spawning Atlantic bluefin tuna; critical habitat for beach mice, Gulf sturgeon, Piping Plover, and Whooping Crane; and the Macondo spill location.

A blowout resulting in a large oil spill (WCD) is an extremely rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in **RDOCD Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **RDOCD Sections 2j** and **9b** provide detail on spill response measures. Therefore, no significant spill impacts on Piping Plovers are expected.

C.3.7 Whooping Crane (Endangered)

The Whooping Crane (*Grus americana*) is an omnivorous, wading bird and an endangered species. There are three wild populations in North America (Whooping Crane Eastern Partnership [WCEP], 2010). One population winters along the Texas coast at Aransas NWR and summers at Wood Buffalo National Park in Canada. This population represents the majority of the world's population of free-ranging Whooping Cranes and reached a record population of 270 at Aransas NWR in December 2008 (WCEP, 2010). A non-migrating population has been re-introduced in central Florida, and another re-introduced population summers in Wisconsin and migrates to the southeastern U.S. for the winter. Whooping Cranes breed, migrate, winter, and forage in a variety of habitats, including coastal marshes and estuaries, inland marshes, lakes, ponds, wet meadows and rivers, and agricultural fields (USFWS, 2007). About 9,000 ha (22,240 ac) of salt flats on Aransas NWR and adjacent islands comprise the principal wintering grounds of the Whooping Crane. Aransas NWR is designated as critical habitat for the species (**Figure 5**). A species description is presented in a recent lease sale EIS (MMS, 2007b).

A large oil spill (WCD) is the only IPF potentially affecting Whooping Cranes. There are no IPFs associated with routine project activities that could affect these birds due to the distance from shore and the lack of any onshore activities near their habitat. A small fuel spill in the lease area would be unlikely to affect Whooping Cranes, as the lease area is 142 miles (229 km) from the nearest shoreline and about 178 miles (287 km) from Aransas NWR. As explained in **Section A.9.2**, a small fuel spill would not be expected to make landfall or reach coastal waters prior to breaking up.

Impacts of a Large Oil Spill (WCD)

The lease area is 178 miles (287 km) from Aransas NWR. Based on the OSRA modeling results, there is a 5% chance that a spill in the lease area could contact shorelines of the Aransas NWR within 30 days.

In the event of oil exposure, Whooping Cranes could physically oil themselves while foraging in oiled areas or secondarily contaminate themselves through ingestion of contaminated shellfish, frogs, and fishes. It is possible that some death of Whooping Cranes could occur. Shell has extensive resources available to protect and rehabilitate wildlife in the event of a spill reaching the shoreline, as detailed in the OSRP.

A blowout resulting in a large oil spill (WCD) is an extremely rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in **RDOCD Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **RDOCD Sections 2j** and **9b** provide detail on spill response measures. Therefore, no significant spill impacts on Whooping Cranes are expected.

C.3.8 Gulf Sturgeon (Threatened)

The Gulf sturgeon (*Acipenser oxyrinchus desotoi*) is a threatened fish species that inhabits major rivers and inner shelf waters from the Mississippi River to the Suwannee River, Florida (Barkuloo, 1988; Wakeford, 2001). An anadromous fish that migrates from the sea upstream into coastal rivers to spawn in freshwater, it historically ranged from the Mississippi River to Charlotte Harbor, Florida (Wakeford, 2001). Today, this range has contracted to encompass major rivers and inner shelf waters from the Mississippi River to the Suwannee River, Florida. Populations have been depleted or even extirpated throughout this range by fishing, shoreline development, dam construction, water quality changes, and other factors (Barkuloo, 1988; Wakeford, 2001). These declines prompted the listing of the Gulf sturgeon as a threatened species in 1991. The best known populations occur in the Apalachicola and Suwannee Rivers in Florida (Carr, 1996; Sulak and Clugston, 1998), the Choctawhatchee River in Alabama (Fox et al., 2000), and the Pearl River in Mississippi/Louisiana (Morrow et al., 1998). Critical habitat in the Gulf extends from Lake Borgne, Louisiana (St. Bernard Parish) to Suwannee Sound, Florida (Levy County) (NMFS, 2010a) (**Figure 5**). A species description is presented in a recent lease sale EIS (MMS, 2007b).

A large oil spill (WCD) is the only IPF potentially affecting Gulf sturgeon. There are no IPFs associated with routine project activities that could affect these fishes. A small fuel spill in the lease area would be unlikely to affect Gulf sturgeon, as the lease area is more than 400 miles (645 km) from the nearest Gulf sturgeon habitat. As explained in **Section A.9.2**, a small fuel spill would not be expected to make landfall or reach coastal waters prior to breaking up.

Impacts of a Large Oil Spill (WCD)

Potential spill impacts on Gulf sturgeon are discussed in recent EISs (MMS, 2007b, 2008) and by the NMFS (2007) in its Biological Opinion for the Five-Year Oil and Gas Leasing Program in the Central and Western Planning Areas of the Gulf of Mexico. For this RDOCD, there are no unique site-specific issues with respect to this species.

The OSRA modeling (**Table 3**) predicts that a spill in the lease area would not contact any shoreline inhabited by Gulf sturgeon within 30 days. It is not known whether these areas could be contacted in the event of a spill persisting for more than 30 days. However, contact is unlikely, as the lease area is more than 400 miles (645 km) from the nearest Gulf sturgeon critical habitat.

In the event of oil reaching Gulf sturgeon habitat, the fish could be affected by direct ingestion, ingestion of oiled prey, or the absorption of dissolved petroleum products through the gills. Based on the life history of this species, subadult and adult Gulf sturgeon would be most vulnerable to an estuarine or marine oil spill, and would be vulnerable only during winter months (between September 1 and April 30) when this species is foraging in estuarine and marine habitats (NMFS, 2007).

A blowout resulting in a large oil spill (WCD) is an extremely rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in **RDOCD Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. Shell has extensive resources available to protect coastal and estuarine wildlife and habitats in the event of a spill reaching the shoreline, as detailed in the OSRP. **RDOCD Sections 2j** and **9b** provide detail on spill response measures. Therefore, no significant spill impacts on Gulf sturgeon are expected.

C.3.9 Beach Mice (Endangered)

Four subspecies of endangered beach mice (*Peromyscus polionotus*) occur on the barrier islands of Alabama and the Florida Panhandle. They are the Alabama, Choctawatchee, Perdido Key, and St. Andrew beach mice. Critical habitat has been designated for all four subspecies (shown for all four subspecies combined in **Figure 5**). Species descriptions are provided in a recent lease sale EIS (MMS, 2007b).

A large oil spill (WCD) is the only IPF potentially affecting beach mice. There are no IPFs associated with routine project activities that could affect these animals due to the distance from shore and the lack of any onshore support activities near their habitat. A small fuel spill in the lease area would not affect beach mice, as the lease area is about 500 miles (800 km) from the nearest beach mouse critical habitat. As explained in **Section A.9.2**, a small fuel spill would not be expected to make landfall or reach coastal waters prior to breaking up.

Impacts of a Large Oil Spill (WCD)

Potential spill impacts on beach mice are discussed in recent EISs (MMS, 2007b, 2008). For this RDOCD, there are no unique site-specific issues with respect to these species. The OSRA modeling predicts that a spill in the lease area would not contact any shoreline inhabited by beach mice within 30 days. It is not known whether Alabama or Florida Panhandle shorelines could be contacted in the event of a spill persisting for more than 30 days. However, contact is unlikely, as the lease area is about 500 miles (800 km) from the nearest beach mouse critical habitat.

In the event of oil contacting these beaches, beach mice could experience several types of direct and indirect impacts. Contact with spilled oil could cause skin and eye irritation and subsequent infection; matting of fur; irritation of sweat glands, ear tissues, and throat tissues; disruption of sight and hearing; asphyxiation from inhalation of fumes; and toxicity from ingestion of oil and contaminated food. Indirect impacts could include reduction of food supply, destruction of habitat, and fouling of nests. Impacts could also occur from vehicular traffic and other activities associated with spill cleanup.

A blowout resulting in a large oil spill (WCD) is an extremely rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in **RDOCD Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **RDOCD Sections 2j** and **9b** provide detail on spill response measures. Therefore, no significant spill impacts on beach mice are expected.

C.4 Coastal and Marine Birds

C.4.1 Marine and Pelagic Birds

A variety of seabirds may occur in the pelagic environment of the project areas (Clapp et al., 1982a,b, 1983; Peake, 1996; Hess and Ribic, 2000). Seabirds spend much of their lives offshore over the open ocean, except during breeding season when they nest along the coast. In addition, other birds such as waterfowl, marsh birds, and shore birds may occasionally be present over open ocean areas. No endangered or threatened bird species are likely to occur at the project area due to the distance from shore. For a discussion of shore birds and coastal nesting birds, see **Section C.4.2**.

Seabirds of the northern Gulf of Mexico were surveyed from ships during the GulfCet II program. Hess and Ribic (2000) reported that terns, storm-petrels, shearwaters, and jaegers were the most frequently sighted seabirds in the deepwater area. From these surveys, four ecological categories of seabirds were documented in the deepwater areas of the Gulf: summer migrants (e.g., shearwaters, storm petrels, and boobies); summer residents that breed in the Gulf (e.g., Sooty Tern, Least Tern, Sandwich Tern, and Magnificent Frigatebird); winter residents (e.g., gannets, gulls, and jaegers); and permanent resident species (e.g., Laughing Gulls, Royal Terns, and Bridled Terns) (Hess and Ribic, 2000).

Common seabird species include Wilson's Storm-Petrel (*Oceanites oceanicus*), Magnificent Frigatebird (*Fregata magnificens*), Northern Gannet (*Morus bassanus*), Masked Booby (*Sula dactylatra*), Brown Booby (*Sula leucogaster*), Cory's Shearwater (*Calonectris diomedea*), Greater Shearwater (*Puffinus gravis*), and Audubon Shearwater (*Puffinus lherminieri*). Seabirds are distributed Gulf-wide and are not specifically associated with the lease area.

Relationships with hydrographic features were found for several seabird species, possibly due to effects of hydrography on nutrient levels and productivity of surface waters where birds forage. GulfCet II did not estimate bird densities; however, Powers (1987) indicates that seabird densities over the open ocean typically are <10 birds/km^2.

Trans-Gulf migrant birds, including shore birds, wading birds, and terrestrial birds may also be present in the lease area. Migrant birds may use offshore structures and platforms for resting, feeding, or as temporary shelter from inclement weather (Russell, 2005). Some birds may be attracted to offshore structures because of the lights and the fish populations that aggregate around these structures.

IPFs potentially affecting marine and pelagic birds include drilling rig presence, noise, and lights; support vessel and helicopter traffic; and two types of accidents (a small fuel spill and a large oil spill represented by the WCD for this RDOCD). Effluent discharges are likely to have negligible impacts on the birds due to rapid dispersion, the small area of ocean affected, the intermittent nature of the discharges, and the mobility of these animals. Compliance with NTL 2007-G03 will minimize the potential for marine debris-related impacts on birds.

Impacts of Drilling Rig Presence, Noise, and Lights

Birds that frequent platforms may be exposed to contaminants including air pollutants and routine discharges, but significant impacts are unlikely due to rapid dispersion. Birds migrating over water have been known to strike offshore structures, resulting in death or injury (Wiese et al., 2001; Russell, 2005). Mortality of migrant birds at tall towers and other land-based structures has been reviewed extensively and the mechanisms involved in platform collisions appear to be similar. In some cases, migrants simply do not see a part of the platform until it is too late. In other cases, navigation may be disrupted by noise (Russell, 2005). On the other hand, offshore structures are suitable stopover habitats for most trans-Gulf migrant species, and most of the migrants that stop over on platforms probably benefit from their stay, particularly in spring (Russell, 2005). Due to the limited scope and short duration of drilling activities in this RDOCD, any impacts on populations of either seabirds or trans-Gulf migrant birds are not expected to be significant.

A recent study in the North Sea indicated that platform lighting causes circling behavior in various birds, especially on cloudy nights; apparently the birds' geomagnetic compass is upset by the red part of the spectrum from the lights currently in use (Nederlandse Aardolie Maatschappij [NAM], 2007). The numbers varied greatly, from none at all to some tens of thousands of birds per night per platform, with an apparent effect radius of up to 3 miles (5 km). A study in the Gulf of Mexico also noted the phenomenon, but did not recommend mitigation (Russell, 2005). Factors to consider in evaluating this impact in the Gulf of Mexico would include the lower incidence of cloudy and foggy days in the Gulf of Mexico vs. the North Sea. Due to the limited scope and short duration of drilling activities proposed in this RDOCD, lighting impacts, collisions, or other adverse effects are unlikely, and no significant impacts are expected.

Impacts of Support Vessel and Helicopter Traffic

Support vessels and helicopters are unlikely to significantly disturb pelagic birds in open, offshore waters. It is likely that individual birds would experience, at most, only short-term behavioral disruption and the impact would not be significant.

Impacts of a Small Fuel Spill

Potential spill impacts on marine birds are discussed in recent EISs (MMS, 2007b, 2008). For this RDOCD, there are no unique site-specific issues with respect to spill impacts on these animals.

The probability of a fuel spill will be minimized by Shell's preventative measures during routine operations including fuel transfer. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the potential for impacts on marine and pelagic birds. **RDOCD Sections 2j** and **9b** provide detail on spill response measures. Given the open ocean location of the lease area, the duration of a small spill and opportunity for impacts to occur would be very brief.

A small fuel spill in offshore waters would produce a slick on the water surface and increase the concentrations of petroleum hydrocarbons and their degradation products. The extent and persistence of impacts would depend on the meteorological and oceanographic conditions at the time and the effectiveness of spill response measures. **Section A.9.2** discusses the likely fate of a small fuel spill and indicates that over 90% would be evaporated or dispersed naturally within 24 hours. The area of the sea surface with diesel fuel on it would range from 0.5 to 5 ha (1.2 to 12 ac) depending on sea state and weather conditions.

Birds exposed to oil on the sea surface could experience direct physical and physiological effects including skin irritation; chemical burns of skin, eyes, and mucous membranes; and inhalation of toxic fumes. Due to the limited areal extent and short duration of water quality impacts from a small fuel spill, secondary impacts due to ingestion of oil via contaminated prey or reductions in prey abundance are unlikely. Due to the low densities of birds in open ocean areas, the small area affected, and the brief duration of the surface slick, no significant impacts on pelagic birds would be expected.

Impacts of a Large Oil Spill (WCD)

Potential spill impacts on marine and pelagic birds are discussed in recent EISs (MMS, 2007b, 2008). For this RDOCD, there are no unique site-specific issues with respect to spill impacts on these animals.

Pelagic seabirds could be exposed to oil from a spill at the project area. Hess and Ribic (2000) reported that terns, storm-petrels, shearwaters, and jaegers were the most frequently sighted seabirds in the deepwater Gulf of Mexico (>200 m). Powers (1987) indicates that seabird densities over the open ocean typically are <10 birds/km^2. The number of pelagic birds that could be affected in open, offshore waters would depend on the extent and persistence of the oil slick.

The recent Macondo spill provides relevant information about the species of pelagic birds that may be affected in the event of a large oil spill. Birds that have been treated for oiling include several pelagic species such as the Northern Gannet, Magnificent Frigatebird, and Masked Booby (International Bird Rescue Research Center, 2010). The Northern Gannet is among the species with the largest numbers of birds affected by the spill.

A blowout resulting in a large oil spill (WCD) is an extremely rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in **RDOCD Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **RDOCD Sections 2j** and **9b** provide detail on spill response measures. Therefore, no significant spill impacts on marine and pelagic birds are expected.

C.4.2 Shore Birds and Coastal Nesting Birds

Threatened and endangered bird species (Piping Plover and Whooping Crane) have been discussed previously in **Section C.3**. Various species of non-endangered birds are also found along the northern Gulf coast, including diving birds, shore birds, marsh birds, wading birds, and waterfowl. Gulf Coast marshes and beaches also provide important feeding grounds and nesting habitats. Species that breed on beaches, flats, dunes, bars, barrier islands, and similar habitats include the Sandwich Tern, Wilson's Plover, Black Skimmer, Forster's Tern, Gull-Billed Tern, Laughing Gull, Least Tern, and Royal Tern (USFWS, 2010b). Additional information is presented in recent lease sale EISs (MMS, 2007b, 2008).

The Eastern Brown Pelican (*Pelecanus occidentalis*) has been delisted from its endangered status (USFWS, 2010c), although still listed as endangered by the State of Mississippi (Mississippi Natural Heritage Program, 2003) and as a species of special concern by the State of Florida (Florida Fish and Wildlife Conservation Commission, 2010). Brown Pelicans inhabit coastal habitats and forage within both coastal waters and waters of the inner continental shelf. Aerial and shipboard surveys, including GulfCet and GulfCet II, indicate that Brown Pelicans do not occur in deep offshore waters (Fritts and Reynolds, 1981; Peake, 1996; Hess and Ribic, 2000). Nearly half the southeastern population of Brown Pelicans lives in the northern Gulf Coast, generally nesting on protected islands (USFWS, 2010b).

The Southern Bald Eagle (*Haliaeetus leucocephalus*) was delisted from its threatened status in the lower 48 states on June 28, 2007. The Bald Eagle is a terrestrial raptor widely distributed across the southern U.S., including coastal habitats along the Gulf of Mexico. The Gulf coast is inhabited by both wintering migrant and resident Bald Eagles (Johnsgard, 1990; Ehrlich et al., 1992).

IPFs potentially affecting shore birds and coastal nesting birds include support vessel and helicopter traffic and a large oil spill (WCD). A small fuel spill in the lease area would be unlikely to affect shore birds or coastal nesting birds, as the lease area is 142 miles (229 km) from the nearest shoreline. As explained in **Section A.9.2**, a small fuel spill would not be expected to make landfall or reach coastal waters prior to breaking up. Compliance with NTL 2007-G03 will minimize the potential for marine debris-related impacts on shore birds.

Impacts of Support Vessel and Helicopter Traffic

Support vessels and helicopters will transit coastal areas near Galveston, Texas, where shore birds and coastal nesting birds may be found. These activities could periodically disturb individuals or groups of birds within sensitive coastal habitats (e.g., wetlands that may support feeding, resting, or breeding birds).

Vessel traffic may disturb some foraging and resting birds. Flushing distances vary between species and between individuals (Rodgers and Schwikert, 2002). The disturbances will be limited to flushing birds away from vessel pathways; known distances are from 20 to 49 m (65 to 160 ft) for personal water craft and 23 to 58 m (75 to 190 ft) for an outboard-powered boat (Rodgers and Schwikert, 2002). Flushing distances may be similar or less for the support vessels to be used for Shell's project, and some species such as gulls are attracted to boats. Support vessels will not approach nesting or breeding areas on the shoreline, so disturbances to nesting birds, eggs and chicks is not expected. Vessel operators will use designated navigation channels and comply with posted speed and wake restrictions while transiting sensitive inland waterways. Due to the limited scope and short duration of drilling activities, any short-term impacts are not expected to be biologically significant to coastal bird populations.

Aircraft traffic can cause some disturbance to birds onshore and offshore. Responses are highly dependent on the type of aircraft, the bird species, the activities that animals were previously engaged in, and previous exposures to overflights (Efroymson et al., 2000). Helicopters seem to cause the most intense responses over other human disturbances for some species (Bélanger and Bédard, 1989; Watson, 1993). However, Federal Aviation Administration Advisory Circular No. 91-36D recommends that pilots maintain a minimum altitude of 610 m (2,000 ft) when flying over noise-sensitive areas such as wildlife refuges, parks, and areas with wilderness characteristics. This is greater than the distance (slant range) at which aircraft overflights have been reported to cause significant behavioral effects on most species of birds studied (Efroymson et al., 2000). With these guidelines in effect, it is likely that individual birds would experience, at most, only short-term behavioral disruption.

Impacts of Large Oil Spill (WCD)

The OSRA results summarized in **Table 3** predict that shorelines of Texas and Louisiana that include habitat for shore birds and coastal nesting birds could be affected within 30 days.

Data from the recent Macondo spill provides additional information about the species of coastal birds that may be affected in the event that a large oil spill reached coastal habitats; this information supplements the analysis presented in the lease sale EIS (MMS, 2007b). According to USFWS (2010d) as of the latest reports, about 5,000 dead birds had been collected since the spill began, and about 1,900 of the dead animals were visibly oiled. In addition, over 2,000 oiled birds have been collected alive and about 1,200 released (NMFS, 2010b). According to the International Bird Rescue Research Center (2010), bird species that have been treated for oiling include:

- Brown Pelican
- White Pelican
- Masked Booby
- Magnificent Frigatebird
- Laughing Gull
- Herring Gull
- Northern Gannet
- Black Crowned Night Heron
- Tri-colored Heron
- Green Heron

- Cattle Egret
- Snowy Egret
- Reddish Egret
- Least Bittern
- Common Tern
- Royal Tern
- Caspian Tern
- Sandwich Tern
- Forsters Tern
- Black Tern
- Gull-billed Tern
- Least Tern
- Black Skimmer
- Black Oystercatcher
- White Ibis
- Roseate Spoonbill
- Willet
- Sanderling
- Dunlin
- Semipalmated Sandpiper
- Killdeer
- King Rail
- Clapper Rail
- Virginia Rail

According to the USFWS (2010d), species with the largest numbers of dead, oiled birds were Laughing Gull, Northern Gannet, Brown Pelican, Royal Tern, Black Skimmer, Least Tern, unidentified Gull, and unidentified Tern. There are no reports of Bald Eagle oiling.

Coastal birds can be exposed to oil as they float on the water's surface, dive during foraging, or wade in oiled coastal waters. Oiled birds can lose the ability to fly, dive for food, or float on the water, which could lead to drowning (USFWS, 2010e). Oil interferes with the water repellency of feathers and can cause hypothermia in the right conditions. As birds groom themselves, they can ingest and inhale the oil on their bodies. Scavengers such as Bald Eagles and gulls can be exposed to oil by feeding on carcasses of contaminated fish and wildlife. While ingestion can kill animals immediately, more often it results in lung, liver, and kidney damage, which can lead to death. Bird eggs may be damaged if an oiled adult sits on the nest.

As noted above, the Brown Pelican was recently removed from the endangered species list. Over 300 dead Brown Pelicans have been collected in the Gulf following the Macondo spill, (USFWS, 2010d). These data indicate that Brown Pelicans may be particularly at risk of oiling in the event of a large spill reaching coastal waters. Issues for Brown Pelicans include direct contact with oil, disturbance by cleanup activities, and long-term habitat contamination.

A blowout resulting in a large oil spill (WCD) is an extremely rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in **RDOCD Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **RDOCD Sections 2j** and **9b** provide detail on spill response measures. Therefore, no significant spill impacts on shore birds and coastal nesting birds are expected.

C.5 Fisheries Resources

C.5.1 Pelagic Communities and Ichthyoplankton

Biggs and Ressler (2000) reviewed the biology of pelagic communities in the deepwater environment of the northern Gulf of Mexico. The biological oceanography of the region is dominated by the influence of the Loop Current, whose surface waters are among the most oligotrophic in the world's oceans. Superimposed on this low-productivity condition are productive "hot spots" associated with entrainment of nutrient-rich Mississippi River water and mesoscale oceanographic features. Anticyclonic and cyclonic hydrographic features play an important role in determining biogeographic patterns and controlling primary productivity in the northern Gulf of Mexico (Biggs and Ressler, 2000).

Most fishes inhabiting shelf or oceanic waters of the Gulf of Mexico have planktonic eggs and larvae (Ditty, 1986; Ditty et al., 1988; Richards et al., 1989, 1993). Pelagic eggs and larvae become part of the planktonic community for various lengths of time (10 to 100 days depending on the species) (MMS, 2007b).

IPFs potentially affecting pelagic communities and ichthyoplankton include drilling rig presence, noise, and lights; water intakes; effluent discharges; and two types of accidents (a small fuel spill and a large oil spill [WCD]).

Impacts of Drilling Rig Presence, Noise, and Lights

The drilling rig, as a floating structure in the deepwater environment, will act as a fish-attracting device (FAD). In oceanic waters, the FAD effect would be most pronounced for epipelagic fishes such as tunas, dolphin, billfishes, and jacks, which are commonly attracted to fixed and drifting surface structures (e.g., Holland et al., 1990; Higashi, 1994; Relini et al., 1994). This FAD effect could possibly enhance the feeding of epipelagic predators by attracting and concentrating smaller fish species. Because the drilling rig is a single, temporary structure, impacts on fish populations, whether beneficial or adverse, are considered minor.

Impacts of Effluent Discharges

Treated sanitary and domestic wastes may have a slight effect on the pelagic environment in the immediate vicinity of these discharges. These wastes may have elevated levels of nutrients, organic matter, and chlorine, but should be diluted rapidly to undetectable levels within tens to hundreds of meters from the source. Minimal impacts on water quality, plankton, and nekton are anticipated.

Deck drainage may have a slight effect on the pelagic environment in the immediate vicinity of these discharges. Deck drainage from contaminated areas will be passed through an oil- and water separator prior to release, and discharges will be monitored for visible sheen. The discharges may have slightly elevated levels of hydrocarbons, but should be diluted rapidly to undetectable levels within tens to hundreds of meters from the source. Minimal impacts on water quality, plankton, and nekton are anticipated.

Other discharges in accordance with the NPDES permit, such as desalination unit brine and uncontaminated cooling water, fire water, and ballast water are expected to be diluted rapidly and have little or no impact on water column biota.

Impacts of Water Intakes

Seawater will be drawn from the ocean for once-through, non-contact cooling of machinery on the drilling rig. The estimated intake and discharge of cooling water is 456,343 BPD (19.2 MGD). The rigs planned for use in this RDOCD are not "new" facilities as defined by the NPDES permit and therefore are not subject to the cooling water intake regulations for Phase III facilities under Section 316(b) of the Clean Water Act.

The intake of seawater for cooling water will entrain plankton. The low intake velocity should allow most strong-swimming juvenile fishes and smaller adults to escape entrainment or impingement. However, drifting plankton would not be able to escape entrainment with the exception of a few fast-swimming larvae of certain taxonomic groups. Those organisms entrained may be stressed or killed, primarily through changes in water temperature during the route from cooling intake structure to discharge structure and mechanical damage (turbulence in pumps and condensers). Due to the limited scope and short duration of drilling activities, any short-term impacts of entrainment are not expected to be biologically significant to plankton or ichthyoplankton populations.

Impacts of a Small Fuel Spill

Potential spill impacts on fisheries resources are discussed in recent EISs (MMS, 2007b, 2008). For this RDOCD, there are no unique site-specific issues with respect to spill impacts.

The probability of a fuel spill will be minimized by Shell's preventative measures during routine operations including fuel transfer. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the potential for impacts on pelagic communities including ichthyoplankton. **RDOCD Sections 2j** and **9b** provide detail on spill response measures. Given the open ocean location of the lease area, the duration of a small spill and opportunity for impacts to occur would be very brief.

A small fuel spill in offshore waters would produce a slick on the water surface and increase the concentrations of petroleum hydrocarbons and their degradation products. The extent and persistence of impacts would depend on the meteorological and oceanographic conditions at the time and the effectiveness of spill response measures. **Section A.9.2** discusses the likely fate of a small fuel spill and indicates that over 90% would be evaporated or dispersed naturally within 24 hours. The area of the sea surface with diesel fuel on it would range from 0.5 to 5 ha (1.2 to 12 ac) depending on sea state and weather conditions.

A small fuel spill could have localized impacts on phytoplankton, zooplankton, and nekton. Due to the limited areal extent and short duration of water quality impacts, small fuel spill would be unlikely to produce detectable impacts on pelagic communities.

Impacts of a Large Oil Spill (WCD)

A large oil spill could affect water column biota including phytoplankton, zooplankton, ichthyoplankton, and nekton. A large spill that persisted for weeks or months would be more likely to affect these communities. While adult and juvenile fishes may actively avoid a large spill, planktonic eggs and larvae would be unable to avoid contact. Eggs and larvae of fishes are especially vulnerable to oiling because they inhabit the upper layers of the water column, and they will die if exposed to certain toxic fractions of spilled oil. Impacts would be potentially greater if local scale currents retained planktonic larval assemblages (and the floating oil slick) within the same water mass.

A blowout resulting in a large oil spill (WCD) is an extremely rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in **RDOCD Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **RDOCD Sections 2j** and **9b** provide detail on spill response measures. Therefore, no significant spill impacts on pelagic communities and ichthyoplankton are expected.

C.5.2 Essential Fish Habitat

Essential Fish Habitat (EFH) is defined as those waters and substrate necessary to fish for spawning, breeding, feeding, and growth to maturity. Under the Magnuson-Stevens Fishery Conservation and Management Act, as amended, Federal agencies are required to consult on activities that may adversely affect EFH designated in Fishery Management Plans developed by the regional Fishery Management Councils.

The Gulf of Mexico Fishery Management Council (GMFMC) has prepared Fishery Management Plans for corals and coral reefs, shrimp, stone crab, spiny lobster, reef fishes, coastal migratory pelagic fishes, and red drum. In 2005, the EFH for these managed species was redefined in Generic Amendment No. 3 to the various Fishery Management Plans (GMFMC, 2005). The EFH for most of these GMFMC-managed species is on the continental shelf in waters shallower than 183 m (600 ft). The shelf edge, which is the outer boundary for coastal migratory pelagic fishes, reef fishes, and shrimp, is about 90 miles (145 km) west of the lease area. EFH for corals and coral reefs includes some shelf-edge topographic features on the Texas-Louisiana OCS, the nearest of which is Mysterious Bank, located approximately 118 miles (190 km) to the west-northwest of the lease area.

Highly migratory pelagic fishes, which occur as transients in the lease area, are the only remaining group for which EFH has been identified in the deepwater Gulf of Mexico. Species in this group, including tunas, swordfishes, billfishes, and sharks, are managed by NMFS. Highly migratory species with EFH at or near the lease area include the following (NMFS, 2009):

- Atlantic bluefin tuna (spawn, eggs, larvae, adults)
- Atlantic skipjack tuna (spawn, eggs, larvae, adults)
- Yellowfin tuna (all)
- Swordfish (all)
- Blue marlin (juveniles, adults)
- White marlin (juveniles, adults)
- Sailfish (juveniles, adults)
- Longbill spearfish (juveniles, adults)
- Longfin mako shark (all)
- Oceantip white shark (all)
- Bigeye thresher shark (all)

Recent research indicates the central and western Gulf of Mexico may be important spawning habitat for Atlantic bluefin tuna, and NMFS (2009) has designated a Habitat Area of Particular Concern (HAPC) for this species. The HAPC covers much of the deepwater Gulf of Mexico, including the lease area (**Figure 5**). The areal extent of the HAPC is approximately 300,000 km^2 (15,000 mi^2). The prevailing assumption is that Atlantic bluefin tuna follow an annual cycle of foraging in June through March off the eastern United States and Canadian coasts, followed by migration to the Gulf of Mexico to spawn in April, May, and June (NMFS, 2009).

Other HAPCs have been identified in the Gulf of Mexico by the GMFMC (2005). These include the Florida Middle Grounds, Madison-Swanson Marine Reserve, Tortugas North and South Ecological Reserves, Pulley Ridge, and several individual reefs and banks of the northwestern Gulf of Mexico: East and West Flower Garden Banks, Stetson Bank, Sonnier Bank, MacNeil, 29 Fathom Bank, Rankin Bright Bank, Geyer Bank, McGrail Bank, Bouma Bank, Rezak Sidner Bank, Alderice Bank, and Jakkula Bank. The nearest of these to the lease area is the West Flower Garden Bank, located 132 miles (212 km) to the north-northeast.

Routine IPFs potentially affecting EFH include drilling rig presence, noise, and lights; water intakes; effluent discharges; and two types of accidents – a small fuel spill and a large oil spill (WCD).

Impacts of Drilling Rig Presence, Noise, and Lights

The drilling rig, as a floating structure in the deepwater environment, will act as an FAD. In oceanic waters, the FAD effect would be most pronounced for epipelagic fishes such as tunas, dolphin, billfishes, and jacks, which are commonly attracted to fixed and drifting surface structures (Holland et al., 1990; Higashi, 1994; Relini et al., 1994). This FAD effect would possibly enhance feeding of epipelagic predators by attracting and concentrating smaller fish species. Because the drilling rig is a single, temporary structure, any impacts on EFH for highly migratory pelagic fishes are considered minor.

Impacts of Effluent Discharges

Other effluent discharges affecting EFH by diminishing ambient water quality include drilling muds and cuttings, treated sanitary and domestic wastes, deck drainage, and miscellaneous discharges such as desalination unit brine and uncontaminated cooling water, fire water, and ballast water. Impacts on water quality have been discussed previously. No significant impacts on EFH for highly migratory pelagic fishes are expected from these discharges.

Impacts of Water Intakes

As noted previously, cooling water intake will cause entrainment and impingement of plankton, including fish eggs and larvae (ichthyoplankton). Due to the limited scope and short duration of drilling activities, any short-term impacts on EFH for highly migratory pelagic fishes are not expected to be biologically significant.

Impacts of a Small Fuel Spill

The probability of a fuel spill will be minimized by Shell's preventative measures during routine operations including fuel transfer. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the potential for impacts on EFH. **RDOCD Sections 2j** and **9b** provide detail on spill response measures. Given the open ocean location of the lease area, the duration of a small spill and opportunity for impacts to occur would be very brief.

Potential spill impacts on EFH are discussed in recent EISs (MMS, 2007b, 2008) and for this RDOCD, there are no unique site-specific issues with respect to spill impacts.

A small fuel spill in offshore waters would produce a slick on the water surface and increase the concentrations of petroleum hydrocarbons and their degradation products. The extent and persistence of impacts would depend on the meteorological and oceanographic conditions at the time and the effectiveness of spill response measures. **Section A.9.2** discusses the likely fate of a small fuel spill and indicates that over 90% would be evaporated or dispersed naturally within 24 hours. The area of the sea surface with diesel fuel on it would range from 0.5 to 5 ha (1.2 to 12 ac) depending on sea state and weather conditions.

A small fuel spill could have localized impacts on EFH for highly migratory pelagic fishes, including tunas, swordfishes, billfishes, and sharks. These species occur as transients in the lease area. A spill would also produce short-term impact on water quality in the HAPC for spawning Atlantic bluefin tuna, which covers much of the deepwater Gulf of Mexico. The areal extent of the affected area would represent a negligible portion of the HAPC.

A small fuel spill would not affect EFH for corals and coral reefs, which includes topographic features on the Texas-Louisiana OCS, the nearest of which is Mysterious Bank, located approximately 118 miles (190 km) to the west-northwest of the lease area. A small fuel spill would float and dissipate on the sea surface and would not contact these features.

Impacts of a Large Oil Spill (WCD)

Potential spill impacts on EFH are discussed in recent EISs (MMS, 2007b, 2008). For this RDOCD, there are no unique site-specific issues with respect to EFH.

An oil spill in offshore waters would temporarily increase hydrocarbon concentrations on the water surface and potentially the subsurface as well. Given the extent of EFH designations in the Gulf of Mexico (GMFMC, 2005; NMFS, 2009), some impact on EFH would be unavoidable.

A large spill could affect the EFH for many managed species including shrimp, stone crab, spiny lobster, reef fishes, coastal migratory pelagic fishes, and red drum. It would result in adverse impacts on water quality and water column biota including phytoplankton, zooplankton, and nekton. In coastal waters, sediments could be contaminated and result in persistent degradation of the seafloor habitat for managed demersal fish and shellfish species.

The lease area is within the HAPC for spawning Atlantic bluefin tuna (NMFS, 2009). A large spill could temporarily degrade the HAPC due to increased hydrocarbon concentrations in the water column, with the potential for lethal or sublethal impacts on spawning tuna. Potential impacts would depend in part on the timing of a spill, as this species migrates to the Gulf of Mexico to spawn in April, May, and June (NMFS, 2009).

The nearest topographic features such as Mysterious Bank and the West Flower Garden Bank are designated as EFH under the corals and coral reefs management plan, and the latter is also an HAPC. An accidental spill would be unlikely to affect either feature. A surface slick would not affect these banks. As noted previously, there are reports of subsurface plumes resulting from the use of subsea dispersants during the Macondo spill. In addition to the distance, the location of these banks on the continental shelf edge is a factor because a plume would have to move upslope to reach them. Spill impacts are considered unlikely because the predominant currents are along the isobath. Near-bottom currents in the lease area are predicted to flow toward the southwest along the escarpment (Nowlin et al., 2001) and typically would not carry a plume up onto the continental shelf.

A blowout resulting in a large oil spill (WCD) is an extremely rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in **RDOCD Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **RDOCD Sections 2j** and **9b** provide detail on spill response measures. Therefore, no significant spill impacts on EFH are expected.

C.6 Archaeological Resources

C.6.1 Shipwreck Sites

AC 857 is not on the list of leases with a high potential for historic shipwrecks. There will be no physical disturbance to the seafloor from anchoring because a DP semisubmersible and a platform rig will be used for drilling. Impacts of a large oil spill (WCD) are the only IPF considered. A small fuel spill would not affect shipwrecks because the oil would float and dissipate on the sea surface.

Impacts of a Large Oil Spill (WCD)

The MMS (2007b) estimated that a severe subsurface blowout could re-suspend and disperse sediments within a 300-m (984-ft) radius. Because there are no historic shipwrecks in the lease area, this impact would not be relevant.

Previous analyses (MMS, 2007a, 2008) concluded that oil spills would be unlikely to affect archaeological sites beyond the immediate vicinity of the wellhead (i.e., due to physical impacts of a blowout) because the oil would rise quickly to the sea surface directly over the spill location. However, during the Macondo spill, subsurface plumes were reported at a water depth of about 1,100 m (3,600 ft), extending at least 22 miles (35 km) from the wellsite and persisting for more than a month (Camilli et al., 2010). The subsurface plumes apparently resulted from the use of dispersants at the wellhead (Joint Analysis Group, 2010c). While the behavior and impacts of subsurface plumes are not well known, a subsurface plume could have the potential to contact shipwreck sites beyond the 300 m (984 ft) radius estimated by MMS (2007a, 2008) depending on its extent, trajectory, and persistence. If oil from a subsea spill should come into contact with wooden shipwrecks on the seafloor it could adversely affect their condition or preservation. Should there be any indication that potential shipwreck sites could be affected, in accordance with NTL 2005-G07 Shell will immediately halt operations, take steps to ensure that the site is not disturbed in any way and contact the Regional Supervisor, Leasing and Environment, within 48 hours of its discovery. Shell would cease all operations within 305 m (1,000 ft) of the site until the Regional Director provides instructions on steps to take to assess the site's potential historic significance and protect it.

A spill entering shallow coastal waters could conceivably contaminate an undiscovered shipwreck site. The OSRA modeling summarized in **Table 3** predicts that Texas and Louisiana shorelines could be contacted by a spill within 30 days. Also as noted by MMS (2007b), should an oil spill contact a coastal historic site, such as a fort or a lighthouse, the major impact would be a temporary, reversible visual impact from oil contact and contamination of the site and its environment.

A blowout resulting in a large oil spill (WCD) is an extremely rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in **RDOCD Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **RDOCD Sections 2j** and **9b** provide detail on spill response measures. Therefore, no significant spill impacts on historic shipwrecks are expected.

C.6.2 Prehistoric Archaeological Sites

Water depth at the Perdido Host location is 2,382 m (7,816 ft). The other surface locations range in water depth from 2,402 to 2,572 m (7,880 to 8,439 ft). These depths are well beyond the 60-

m (197-ft) depth contour used by the BOEMRE as the seaward extent for prehistoric archaeological site potential in the Gulf of Mexico. Because prehistoric archaeological sites are not found in the lease area, the only relevant IPF is a large oil spill (WCD). A small fuel spill would not affect prehistoric archaeological resources because the oil would float and dissipate on the sea surface.

Impacts of a Large Oil Spill (WCD)

Because prehistoric archaeological sites are not found in the lease area, they would not be affected by the physical effects of a subsea blowout. The MMS (2007b) estimates that a severe subsurface blowout could re-suspend and disperse sediments within a 300-m (984-ft) radius.

Along the northern Gulf coast, prehistoric sites occur frequently along the barrier islands and mainland coast and along the margins of bays and bayous (MMS, 2007b). The OSRA modeling summarized in **Table 3** predicts that Texas and Louisiana shorelines could be contacted by a spill within 30 days. A spill reaching a prehistoric site along these shorelines could coat fragile artifacts or site features and compromise the potential for radiocarbon dating organic materials in a site (although other dating methods are available and it is possible to decontaminate an oiled sample for radiocarbon dating). Coastal prehistoric sites could also be damaged by spill cleanup operations (e.g., by destroying fragile artifacts and disturbing the provenance of artifacts and site features).

A blowout resulting in a large oil spill (WCD) is an extremely rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in **RDOCD Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **RDOCD Sections 2j** and **9b** provide detail on spill response measures. Therefore, no significant spill impacts on archaeological resources are expected.

C.7 Coastal Habitats and Protected Areas

Coastal habitats in the northeastern Gulf of Mexico that may be affected by oil and gas activities are described in recent EISs (MMS, 2007b, 2008) and in a literature review by Collard and Way (1997). Sensitive coastal habitats are also tabulated in the OSRP. Coastal habitats inshore of the project area include barrier beaches and dunes, wetlands, and submerged seagrass beds. Generally, most of the northeastern Gulf is fringed by barrier beaches, with wetlands and/or submerged seagrass beds occurring in sheltered areas behind the barrier islands and in estuaries.

Due to the distance from shore, there are no IPFs associated with routine activities that are likely to affect beaches and dunes, wetlands, seagrass beds, coastal wildlife refuges, wilderness areas, or any other managed or protected coastal area. The support bases at Galveston are not in a wildlife refuge or a wilderness area. Potential impacts of support vessel traffic are addressed briefly below.

A small fuel spill in the lease area would be unlikely to affect coastal habitats, as the lease area is 142 miles (229 km) from the nearest shoreline. As explained in **Section A.9.2**, a small fuel spill would not be expected to make landfall or reach coastal waters prior to breaking up.

Impacts of Support Vessel Traffic

For OCS activities in general, support operations, including crew boats and supply boats, may have a minor incremental impact on coastal habitats. Over time with a large number of vessel trips, vessel wakes can erode shorelines along inlets, channels, and harbors. Support operations, including crew boats and supply boats as detailed in **RDOCD Section 14**, may have a minor incremental impact on coastal habitats or protected areas. Impacts will be minimized by following the speed and wake restrictions in harbors and channels.

Impacts of a Large Oil Spill (WCD)

Potential spill impacts on coastal habitats are discussed in recent EISs (MMS, 2007b, 2008). Coastal habitats inshore of the project area include barrier beaches and dunes, wetlands, and submerged seagrass beds. For this RDOCD, there are no unique site-specific issues with respect to coastal habitats.

The OSRA results summarized in **Table 3** predict that shorelines of Texas and Louisiana could be affected within 30 days. The model predicts no shoreline contacts within 3 days of a spill. After 30 days, 12 counties or parishes may be contacted, including 11 Texas counties and 1 Louisiana parish. Matagorda County, Texas, has the highest probability of contact for the 30-day interval.

The Texas and Louisiana shorelines within the geographic range predicted by the OSRA modeling include extensive barrier beaches and wetlands, with submerged seagrass beds occurring in sheltered areas behind the barrier islands and in estuaries. National wildlife refuges and other protected areas along the coast are discussed in the lease sale EIS (MMS, 2007b) and Shell's OSRP. Coastal wildlife refuges, wilderness areas, and state and national parks within the geographic range of the potential shoreline contacts include the following:

- Las Palomas Wildlife Management Area, Boca Chica Unit
- Laguna Atascosa NWR
- Brazos Island State Park
- Padre Island National Seashore
- Mustang Island State Park
- Aransas NWR
- Matagorda Island State Park
- Big Boggy NWR
- San Bernard NWR
- Mad Island Wildlife Management Area
- Peach Point Wildlife Management Area
- Galveston Island State Park
- Brazoria NWR
- Anahuac NWR
- McFadden NWR
- Sea Rim State Park
- Texas Point NWR
- Sabine NWR
- Rockefeller Wildlife Management Area and Game Preserve

The OSRA modeling does not indicate whether other, more distant coastal areas could be affected if an oil spill persisted for more than 30 days. Additional NWRs and managed wildlife areas occur along the Gulf coast. These areas include habitats such as barrier beach and dune systems, wetlands, and submerged seagrass beds that support diverse wildlife, including endangered or threatened species.

The level of impacts from oil spills on coastal habitats depends on many factors, including the oil characteristics, the geographic location of the landfall, and the weather and oceanographic conditions at the time (MMS, 2007b). Oil that makes it to beaches may be either liquid weathered oil, an oil-and-water mousse, or tarballs (MMS, 2007b). Oil is generally deposited on beaches in lines defined by wave action at the time of landfall. Oil that remains on the beach will thicken as its volatile components are lost. Thickened oil may form tarballs or aggregations that incorporate sand, shell, and other materials into its mass. Tar may be buried to varying depths under the sand. On warm days, both exposed and buried tarballs may liquefy and ooze. Oozing may also serve to expand the size of a mass as it incorporates beach materials. Oil on beaches may be cleaned up manually, mechanically, or both. Some oil can remain on the beach at varying depths and may persist for several years as it slowly biodegrades and volatilizes.

Wetlands are highly sensitive to oiling. The MMS (2007b) predicted that for every 50 bbl of oil contacting wetlands, approximately 2.7 ha (6.7 ac) of wetland vegetation will experience dieback. Thirty percent of these damaged wetlands are assumed to recover within 4 years, and 85% within 10 years. About 15% of the contacted wetlands are expected to be converted permanently to open-water habitat. The critical concentration of oil is that concentration above which impacts to wetlands will be long term and recovery will take longer than two growing seasons, and which causes plant mortality and some permanent wetland loss. Critical concentrations of various oils are expected to vary broadly for wetland types and wetland plant species. Louisiana wetlands are assumed to be more sensitive to oil contact than elsewhere in the Gulf because of high cumulative stress (MMS, 2007b). In addition to the direct impacts of oil, cleanup activities in marshes may accelerate rates of erosion and retard recovery rates, which have been reported to require from years to decades following a spill (MMS, 2007b).

A blowout resulting in a large oil spill (WCD) is an extremely rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in **RDOCD Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **RDOCD Sections 2j** and **9b** provide detail on spill response measures. Therefore, no significant spill impacts on coastal habitats are expected.

C.8 Socioeconomic and Other Resources

C.8.1 Recreational and Commercial Fishing

The main commercial fishing activity in deep waters of the northern Gulf of Mexico is pelagic longlining for tunas, swordfishes, and other billfishes (Continental Shelf Associates, Inc., 2002). Pelagic longlining has occurred historically in the project area, primarily during spring and summer. In August 2000, the Federal government closed two areas in the northeastern Gulf of Mexico to longline fishing (65 Federal Register 47214, August 1, 2000). The lease is outside of the closure areas.

Longline gear consists of monofilament line deployed from a moving vessel and generally allowed to drift for 4 to 5 hours (Continental Shelf Associates, Inc., 2002). As the mainline is put out, baited leaders and buoys are clipped in place at regular intervals. It takes 8 to 10 hours to deploy a longline and about the same time to retrieve it. Longlines are often set near oceanographic features such as fronts or downwellings, with the aid of sophisticated on-board temperature sensors, depth finders, and positioning equipment. Vessels are 10 to 30 m long, and their trips last from about 1 to 3 weeks. The main homeports for longlining vessels are in Louisiana (Dulac and Venice) and Florida (Destin, Madeira Beach, and Panama City).

It is unlikely that any commercial fishing activity other than longlining occurs at or near the project area. Benthic species targeted by commercial fishers occur on the upper continental slope, well inshore of the project area. Royal red shrimp are caught by trawlers in water depths of about 250 to 550 m (820 to 1,804 ft). Tilefish are caught by bottom longlining in water depths from about 165 to 450 m (540 to 1,476 ft) (Continental Shelf Associates, Inc., 2002).

Most recreational fishing activity in the region occurs in water depths less than 200 m (656 ft) (Continental Shelf Associates, Inc., 1997, 2002). In deeper water, the main attraction to recreational fishers would be petroleum platforms offshore Texas and Louisiana. Recreational fishing boats occasionally visit the Perdido area. The level of activity tends to correspond with the seasons and weather. In winter months, when seas tend to be rough, one to three recreational fishing boats will fish in the Perido area each month. In the summer months, when seas tend to calm and weather is more favorable, approximately 10 to 12 boats fish in the area each month. In some instances, such as fishing tournaments, there are over five fishing boats in the area on a single day.

The only routine IPF potentially affecting fisheries is drilling rig presence (including noise and lights). Two potential accidents are also addressed below – a small fuel spill and a large oil spill (WCD).

Impacts of Drilling Rig Presence

There is a slight possibility of pelagic longlines becoming entangled in the drilling rig. For example, in January 1999, a portion of a pelagic longline snagged on the acoustic Doppler current profiler of a drillship working in the Gulf of Mexico (Continental Shelf Associates, Inc., 2002). The line was removed without incident. Generally, longline fishers use radar and are aware of offshore structures and ships when placing their sets. Therefore, little or no impact on pelagic longlining is expected.

No adverse impacts on recreational fishing are anticipated. Other factors such as effluent discharges are likely to have negligible impacts on commercial or recreational fisheries due to rapid dispersion, the small area of ocean affected, and the intermittent nature of the discharges.

Impacts of a Small Fuel Spill

The probability of a fuel spill will be minimized by Shell's preventative measures during routine operations including fuel transfer. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the potential for impacts. **RDOCD Sections 2j** and **9b** provide detail on spill response measures. Given the open ocean location of the lease area, the duration of a small spill and opportunity for impacts to occur would be very brief.

Pelagic longlining activities in the lease area, if any, could be interrupted in the event of a small fuel spill. The area of the sea surface with diesel fuel on it would range from 0.5 to 5 ha (1.2 to 12 ac) depending on sea state and weather conditions. Fishing activities could be interrupted due to the activities of response vessels operating in the lease area. A small fuel spill would not affect coastal water quality because the spill would not be expected to make landfall or reach coastal waters prior to breaking up (see **Section A.9.2**).

Impacts of a Large Oil Spill (WCD)

Potential spill impacts on fishing activities are discussed in recent EISs (MMS, 2007b, 2008). For this RDOCD, there are no unique site-specific issues with respect to this activity.

Pelagic longlining activities in the lease area and other fishing activities in the northern Gulf of Mexico could be interrupted in the event of a large oil spill. A spill may or may not result in fishery closures, depending on the duration of the spill, the oceanographic and meteorological conditions at the time, and the effectiveness of spill response measures. The recent Macondo spill provides information about the maximum potential extent of fishery closures in the event of a large oil spill in the Gulf of Mexico (NMFS, 2010c). At its peak on July 12, 2010, closures encompassed 217,821 km^2 (84,101 mi^2), or 34.8% of the U.S. Exclusive Economic Zone (EEZ) in the Gulf of Mexico.

A blowout resulting in a large oil spill (WCD) is an extremely rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in **RDOCD Section 2j.**

In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **RDOCD Sections 2j** and **9b** provide detail on spill response measures. Therefore, no significant spill impacts on fishing activities are expected.

C.8.2 Public Health and Safety

There are no IPFs associated with routine operations that are expected to affect public health and safety. Impacts of a small fuel spill and a large oil spill (WCD) are addressed below.

Impacts of a Small Fuel Spill

The probability of a fuel spill will be minimized by Shell's preventative measures during routine operations including fuel transfer. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the potential for impacts. **RDOCD Sections 2j** and **9b** provide detail on spill response measures.

A small fuel spill would not have any impacts on public health and safety because it would affect only a small area of the open ocean 142 miles (229 km) from the nearest shoreline and nearly all of the diesel fuel would evaporate or disperse naturally within 24 hours. Response crews would be equipped with appropriate safety equipment to avoid injury and health effects. A small fuel spill would not be expected to make landfall or reach coastal waters prior to breaking up (see **Section A.9.2**).

Impacts of a Large Oil Spill (WCD)

In the event of a large spill from a blowout, the main safety and health concerns are those of the offshore personnel involved in the incident and those responding to the spill. The proposed activities will be covered by the OSRP, and, in addition, the drilling rig maintains a Shipboard Oil Pollution Emergency Plan as required under MARPOL 73/78.

Depending on the spill rate and duration, the physical/chemical characteristics of the oil, the meteorological and oceanographic conditions at the time, and the effectiveness of spill response measures, the public could be exposed to oil on the water and along the shoreline, including skin contact or breathing VOCs. Crude oil is a highly flammable material and any smoke or vapors from a crude oil fire can cause irritation, and in large quantities, may pose a health hazard.

Data from the recent Macondo spill provide relevant information about the types of health issues that may occur in the event of a large oil spill (Centers for Disease Control and Prevention, 2010a). Wildlife cleaning and rehabilitation workers have reported concerns including scrapes and cuts, itchy or red skin or rash, and symptoms of headache or feeling faint, dizzy, or fatigued. Hand, shoulder, or back pain was also reported by some wildlife cleaning workers. Personnel working on offshore vessels or providing direct oversight to offshore vessels, including USCG personnel, civilian contractors, and other responders who were exposed to oil and dispersants had 7 to 12 times higher prevalences of upper respiratory symptoms and cough than those not exposed (Centers for Disease Control and Prevention, 2010b). Another potential occupational hazard for spill response workers in general was heat stress from work in a hot and humid environment. Initial symptoms from cleanup workers who sought medical care in Louisiana were typical of acute exposure to hydrocarbons or H_2S such as headaches, dizziness, nausea, vomiting, cough, respiratory distress, and chest pain (Solomon and Janssen, 2010). Health effects reported from previous oil spills, such as the *Exxon Valdez* in 1989, were primarily acute injuries consisting of headaches, throat irritation, and sore or itchy eyes, but respiratory problems and dermatitis along with chronic airway disease have also been reported (Solomon and Janssen, 2010).

A blowout resulting in a large oil spill (WCD) is an extremely rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in **RDOCD Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **RDOCD Sections 2j** and **9b** provide detail on spill response measures. Therefore, no significant spill impacts on public health and safety are expected.

C.8.3 Employment and Infrastructure

There are no IPFs associated with routine operations that are expected to affect employment and infrastructure. The project involves drilling wells with support from existing shore-base facilities in Texas. No new or expanded facilities will be constructed, and no new employees are expected to move permanently into the area. The project will have a negligible impact on socioeconomic conditions such as local employment, existing offshore and coastal infrastructure (including major sources of supplies, services, energy, and water), and minority and lower income groups. Impacts of a small fuel spill and a large oil spill (WCD) are addressed below.

Impacts of a Small Fuel Spill

The probability of a fuel spill will be minimized by Shell's preventative measures during routine operations including fuel transfer. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the potential for impacts. **RDOCD Sections 2j** and **9b** provide detail on spill response measures. Given the open ocean location of the lease area, the duration of a small spill and opportunity for impacts to occur would be very brief.

A small fuel spill that is dissipated within a few days would have little or no economic impact, as the spill response would use existing facilities, resources, and personnel.

Impacts of a Large Oil Spill (WCD)

Potential socioeconomic impacts of an oil spill are discussed in recent EISs (MMS, 2007b, 2008). For this RDOCD, there are no unique site-specific issues with respect to employment and coastal infrastructure. A large spill could cause economic impacts in several ways: it could result in extensive fishery closures that put fishermen out of work; it could result in temporary employment as part of the response effort; it could result in adverse publicity that affects employment in coastal recreation and tourism industries; and it could result in another suspension of OCS drilling activities, including service and support operations that are an important part of local economies.

The lease area is 142 miles (229 km) from the nearest shoreline. Based on OSRA modeling as summarized in **Table 3**, Texas and Louisiana coastal areas are the most likely to be contacted by a spill. It is not known whether other, more distant coastal areas could be affected if an oil spill persisted for more than 30 days.

A blowout resulting in a large oil spill (WCD) is an extremely rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in **RDOCD Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **RDOCD Sections 2j** and **9b** provide detail on spill response measures. Therefore, no significant spill impacts on employment and infrastructure are expected.

C.8.4 Recreation and Tourism

There are no known recreational uses of the lease area. Recreational resources and tourism in coastal areas would not be affected by any routine activities due to the distance from shore. Compliance with NTL 2007-G03 will minimize the chance of trash or debris being lost overboard from the drilling rig and subsequently washing up on beaches.

Impacts of a Small Fuel Spill

The probability of a fuel spill will be minimized by Shell's preventative measures during routine operations including fuel transfer. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the potential for impacts. **RDOCD Sections 2j** and **9b** provide detail on spill response measures. Given the open ocean location of the lease area, the duration of a small spill and opportunity for impacts to occur would be very brief.

A small fuel spill in the lease area would be unlikely to affect recreation and tourism. There are no known recreational or tourism activities occurring in the lease area, and as explained in **Section A.9.2**, a small fuel spill would not be expected to make landfall or reach coastal waters prior to breaking up.

Impacts of a Large Oil Spill (WCD)

Potential impacts of an oil spill on recreation and tourism are discussed in recent EISs (MMS, 2007b, 2008). For this RDOCD, there are no unique site-specific issues with respect to these impacts.

Impacts on recreation and tourism would vary depending on the duration of the spill and its fate including the effectiveness of response measures. A large spill that reached coastal waters and shorelines could adversely affect recreation and tourism by contaminating beaches and wetlands, resulting in negative publicity that encourages people to stay away. Based on OSRA modeling as summarized in **Table 3**, Texas and Louisiana coastal areas are the most likely to be contacted by a spill. These include popular beaches and recreational sites along the coast. It is not known whether other, more distant coastal areas could be affected if an oil spill persisted for more than 30 days.

In addition to the analysis presented by MMS (2007b, 2008), recent and ongoing studies have explored the economic impacts of the Macondo spill including tourism and "brand" damage (IEM, 2010; Oxford Economics, 2010). The U.S. Travel Association has estimated the economic impact of the Macondo spill on tourism across the Gulf Coast over a 3-year period at $22.7 billion (Oxford Economics, 2010).

A blowout resulting in a large oil spill (WCD) is an extremely rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in **RDOCD Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **RDOCD Sections 2j** and **9b** provide detail on spill response measures. Therefore, no significant spill impacts on recreation and tourism are expected.

C.8.5 Land Use

Land use along the northern Gulf coast is discussed in recent lease sale EISs (MMS, 2007b, 2008). There are no routine IPFs potentially affecting land use. The project will use existing onshore support facilities in Texas. The land use at the existing shore-base sites is industrial. The project will not involve any new construction or changes to existing land use and, therefore, will not have any impacts. Levels of boat and helicopter traffic, as well as demand for goods and services including scarce coastal resources, will represent a small fraction of the level of activity occurring at the shore bases.

A large oil spill (WCD) is the only relevant IPF. A small fuel spill would not have any impacts on land use, as the response would be staged out of existing shore bases and facilities.

Impacts of a Large Oil Spill (WCD)

The initial response for a large oil spill would be staged out of existing facilities, with no effect on land use. A large spill could have limited temporary impacts on land use along the coast if additional staging areas were needed. For example, during the Macondo spill, temporary staging areas were established in Louisiana, Mississippi, Alabama, and Florida for spill response and cleanup efforts. In the event of a large spill in the lease area, similar temporary staging areas could be needed. These areas would eventually return to their original use as the response is demobilized.

A blowout resulting in a large oil spill (WCD) is an extremely rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in **RDOCD Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **RDOCD Sections 2j** and **9b** provide detail on spill response measures. Therefore, no significant spill impacts on land use are expected.

C.8.6 Other Marine Uses

The lease area is not located within any USCG-designated fairway or shipping lane. The lease area is in Military Warning Area W-602, and Shell will comply with BOEMRE requirements and lease stipulations to avoid impacts on uses of the area by military vessels and aircraft.

Shell has installed service and production sleds, manifolds, umbilicals, and umbilical termination hubs on the seafloor as described in its previously approved DOCD. These features will not be affected because there will be no anchoring. There are no other known marine uses of the lease area.

There are no IPFs from routine project activities that are likely to affect shipping or other marine uses. A large oil spill (WCD) is the only relevant accident IPF. A small fuel spill would not have any impacts on other marine uses, as the spill and response activities would be mainly within the lease area and the duration would be brief.

Impacts of a Large Oil Spill (WCD)

An accidental spill would be unlikely to significantly affect shipping or other marine uses. The block is not located within any USCG-designated fairway or shipping lane. In the event of a large spill requiring numerous response vessels, coordination would be required to manage the vessel traffic for safe operations. Shell will comply with BOEMRE requirements and lease stipulations to avoid impacts on uses of the area by military vessels and aircraft.

In the event of a large spill requiring numerous vessels in the area, coordination would be required to ensure that no anchoring or seafloor-disturbing activities occur near the existing pipelines and flowlines.

A blowout resulting in a large oil spill (WCD) is an extremely rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in **RDOCD Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **RDOCD Sections 2j** and **9b** provide detail on spill response measures. Therefore, no significant spill impacts on other marine uses are expected.

C.9 Cumulative Impacts

For purposes of NEPA, cumulative impact is defined as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions" (40 CFR 1508.7). Any single activity or action may have a negligible impact(s) by itself, but when combined with impacts from other activities in the same area and/or time period, substantial impacts may result.

Prior Studies. Prior to lease sale 161, in which AC 857 was acquired, MMS prepared an EIS (OCS EIS/EA MMS 95-0058), in which it analyzed the environmental impact of activities that might occur in that lease area. The MMS also recently analyzed the cumulative impacts of OCS development activities similar to those planned in this RDOCD in several documents. The level and types of activities planned in Shell's DOCD are within the range of activities described and evaluated in the Final EIS for Gulf of Mexico OCS Oil and Gas Lease Sales 2007-2012: Western Planning Area Sales 204, 207, 210, 215, and 218, and Central Planning Area Sales 205, 206, 208, 213, 216, and 222 (MMS, 2007b), as updated by a 2008 Final Supplemental EIS for Gulf of Mexico OCS Oil and Gas Lease Sales 2009-2012: Central Planning Area Sales 208, 213, 216, and 222 and Western Planning Area Sales 210, 215, and 218 (MMS, 2008). The MMS also prepared a Grid EA for Shell's Perdido Development in AC 812, 813, 814, and 857 (MMS, 2007c). Past, present, and reasonably foreseeable activities were identified in the cumulative effects scenario. These documents are incorporated by reference.

Description of Activities Reasonably Expected to Occur in the Vicinity of Project Area. Shell currently is unaware of any projects that are planned to occur within the immediate vicinity of Shell's proposed project.

Cumulative Impacts of Activities in the RDOCD. The MMS (2007b) multi-lease-sale EIS included a lengthy discussion of cumulative impacts, which analyzed the environmental and socioeconomic impacts from the incremental impact of the 11 proposed lease sales, in addition to all activities (including non-OCS activities) projected to occur from past, proposed, and future lease sales during the 40-year period of 2007 to 2046 (see EIS page 4-301). The EIS considered exploration, delineation, and development wells; platform installation; service-vessel trips; and oil spills. The EIS examined the potential cumulative effects on each specific resource for the entire Gulf of Mexico.

The level and type of activity proposed in Shell's RDOCD are within the range of activities described and evaluated in the recent multi-lease-sale EISs. This EIA incorporates and builds on these analyses by examining the potential impacts on physical, biological, and socioeconomic resources from the work planned in this RDOCD, in conjunction with the other reasonably foreseeable activities expected to occur in the Gulf of Mexico, as well as the known impacts from the Macondo spill in Mississippi Canyon (MC) 252. While another large oil spill could have significant impacts, the numerous new safety measures implemented by BOEMRE, and further mitigation and safety measures proposed by Shell in its RDOCD, result in an environmentally safer drilling program that reduces the likelihood of another large spill, and improves the effectiveness of any response in the extremely unlikely event that another large spill occurs. Thus, for all impacts, the incremental contribution of Shell's proposed actions to the cumulative impacts analysis in these prior analyses is not significant.

C.9.1 Cumulative Impacts to Physical /Chemical Resources

The work planned in this RDOCD is limited in geographic scope and duration, and the impacts on the physical/chemical environment will be correspondingly limited.

Air Quality. Emissions from pollutants into the atmosphere from activities are not projected to have significant effects on onshore air quality because of the prevailing atmospheric conditions, emission rates and heights, and resulting pollutant concentrations. As BOEMRE found in the multi-lease-sale EISs, the incremental contribution of activities similar to Shell's proposed activities to the cumulative impacts is not significant and will not cause or contribute to a violation of any national ambient air quality standard (MMS, 2007b, 2008). In addition, the cumulative contribution to visibility impairment is also very small (MMS, 2007b, 2008). Since BOEMRE completed the multi-lease-sale EISs, USEPA has adopted a new short-term NAAQS for nitrogen dioxide. The standard has not yet been implemented in the Gulf Coast states, but preliminary analysis indicates that emissions from Shell's RDOCD are not likely to contribute to violations of that standard.

Climate Change. Carbon dioxide (CO_2) and methane (CH_4) emissions from the project would constitute a small incremental contribution to greenhouse gas emissions from all OCS activities. According to the Programmatic EIS (MMS, 2007a), estimated CO_2 emissions from all OCS activities in the 2007-2012 leasing program are about 0.08% to 0.016% of the global CO_2 emissions from fossil fuel combustion. Greenhouse gas emissions may contribute to climate change, with important effects on temperature, rainfall, frequency of severe weather, ocean acidification, and sea level rise (Intergovernmental Panel on Climate Change, 2007). In the Gulf of Mexico, sea level rise is an important issue due to the ongoing dramatic losses in coastal wetlands, particularly in coastal Louisiana. Nevertheless, greenhouse gas emissions from the proposed RDOCD in combination with such emissions from reasonably foreseeable projects in the vicinity are not expected to significantly change global climate change impacts that could in turn affect the Gulf of Mexico area.

Water Quality. Shell's project will have some minor water quality impacts due to the NPDES-permitted discharge of drilling muds and cuttings, treated sanitary and domestic wastes, excess cement, non-contact cooling water, deck drainage, desalination unit brine, uncontaminated fire water, and ballast water. These effects are expected to be minor (localized to the area within a few hundred meters of the drilling rig), and temporary (lasting only hours longer than the disturbance or discharge). Any cumulative effects to water quality are expected to be negligible.

New Information. The only new, potentially significant information available since preparation of the multi-lease-sale EISs arises from the Macondo spill. The Macondo spill caused short-term, localized air quality impacts, e.g., from evaporation of volatile hydrocarbons and *in-situ* burning of floating oil. Monitoring by the USEPA (2010b) has found levels of ozone and particulates ranging from "good" to "unhealthy for sensitive groups" on USEPA's Air Quality Index; these are at levels well below those that would cause short-term health problems. The air monitoring conducted to date has not found any pollutants at levels expected to cause long-term harm (USEPA, 2010b). Satellite imagery provides no evidence that the lease area, which is located approximately 435 miles (700 km) west-southwest of the Macondo spill site, received any surface slicks of oil (ESRI, 2010). Therefore, based on the information currently available, there is no reason to expect any change in air quality conditions or cumulative impacts from those predicted in the multi-lease-sale EISs.

The Macondo spill also resulted in extensive water quality impacts. In addition to the oil slick on the sea surface, plumes of submerged oil droplets were produced when subsea dispersants were applied at the wellhead (Camilli et al., 2010; Hazen et al., 2010; Joint Analysis Group, 2010a,b,c). Satellite imagery provides no evidence that the lease area received any surface slicks of oil (ESRI, 2010), and due to the distance from the lease area, it is unlikely that subsurface plumes have affected water quality in or near the lease area. Prior to the incident, water quality in deep, offshore waters was expected to be good, with low levels of contaminants (Kennicutt, 2000). Based on the information currently available, there is no reason to expect any change in water quality conditions or cumulative impacts from those predicted in the multi-lease-sale EISs.

C.9.2 Cumulative Impacts to Biological Resources

The work planned in this RDOCD is limited in geographic scope and duration, and the impacts on biological resources will be correspondingly limited.

Seafloor Habitats and Biota. Effects on seafloor habitats and biota from discharges of drilling mud and cuttings are expected to be minor and limited to a small area. There are no areas that may support high-density deepwater benthic communities within 610 m (2,000 ft) of the wellsites as required by NTL 2009-G40. Soft-bottom communities are ubiquitous along the northern Gulf of Mexico continental slope, and the extent of benthic impacts during this project is insignificant regionally. As noted in the multi-lease-sale EISs, the incremental contributions of activities similar to Shell's proposed activities to the cumulative impacts is not significant (MMS, 2007b, page 4-325).

Threatened, Endangered, and Protected Species. Threatened and endangered species reasonably likely to occur in the lease area include the sperm whale and five species of sea turtles. Potential impact sources include drilling rig presence including noise and lights; marine debris; and support vessel and aircraft traffic. Potential effects for these species would be limited and temporary, and would be reduced by Shell's compliance with all BOEMRE-required mitigation measures including NTLs 2007-G03 and 2007-G04. No significant cumulative impacts are expected.

Coastal and Marine Birds. Some birds may be attracted to offshore structures because of the lights and the fish populations that aggregate around these structures. Birds that frequent platforms may be exposed to contaminants including air pollutants and routine discharges, but significant impacts are unlikely due to rapid dispersion. Shell's compliance with NTL 2007-G03 will minimize the likelihood of debris-related impacts on birds. Support vessel and helicopter traffic may disturb some foraging and resting birds; however, it is likely that individual birds would experience, at most, only short-term behavioral disruption. Due to the limited scope and short duration of drilling activities, collisions or other adverse effects are unlikely, and no significant cumulative impacts are expected.

Fisheries Resources. Drilling rigs are known to be "fish-attracting devices" such that some species of epipelagic fishes may be attracted to the rig and potentially attract predators, but these short-term effects are expected to be small given the isolated nature of the drilling rig and would not be considered a significant impact on pelagic communities, fishery resources, or EFH. When the drilling rig is on-site, these effects would be temporarily additive to those associated with other exploration and production structures in the area, but would occur at low levels such that the cumulative effect would be negligible.

Coastal Habitats. Due to the distance from shore, routine activities are not expected to have any impacts on beaches and dunes, wetlands, seagrass beds, coastal wildlife refuges, wilderness areas, or any other managed or protected coastal area. The support bases at Galveston are not in a wildlife refuge or a wilderness area. Support operations, including crew boats and supply boats, may have a minor incremental impact on coastal habitats. Over time with a large number of vessel trips, vessel wakes can erode shorelines along inlets, channels, and harbors. Impacts will be minimized by following the speed and wake restrictions in harbors and channels.

New Information. The only new, potentially significant information available since preparation of the multi-lease-sale EISs arises from the Macondo spill. The spill has resulted in impacts on biological resources, including visibly oiled and/or dead birds, marine mammals, and sea turtles, as well as oiling of coastal habitats from approximately the Texas/Louisiana border to the Florida Panhandle. Another large spill could result in significant cumulative impacts to these resources. However, for all the reasons discussed in the RDOCD, Shell's NTL 2010-N06 response, the OSRP, and herein, the likelihood of a catastrophic well control event resulting in significant amounts of oil in the water is extremely remote. Therefore, Shell's proposed activities are not expected to result in any cumulative impacts to biological resources affected by the Macondo spill, nor should they have any impact on the previously-conducted cumulative impact analyses.

Regarding deepwater benthic communities, the multi-lease-sale EISs (MMS, 2007a, 2008) assumed that oil spills would be unlikely to affect benthic communities beyond the immediate vicinity of the wellhead (i.e., due to physical impacts of a blowout) because the oil would rise quickly to the sea surface directly over the spill location. However, during the Macondo spill, subsurface plumes were reported at a water depth of about 1,100 m (3,600 ft), extending at least 22 miles (35 km) from the wellsite and persisting for more than a month (Camilli et al., 2010). The subsurface plumes apparently resulted from the use of dispersants at the wellhead (Joint Analysis Group, 2010c). While the behavior and impacts of subsurface plumes are not well known, a subsurface plume could contact the seafloor and affect benthic communities beyond the 300 m (984 ft) radius estimated by MMS (2007a, 2008) depending on its extent, trajectory, and persistence. As previously noted in **Section C.2.2**, areas of dead and dying corals were observed during a recent (October 2010) survey of deepwater coral habitats 7 miles (11 km) southwest of the Macondo spill site (BOEMRE, 2010). Until laboratory analyses are conducted, scientists cannot be certain what caused the impacts. However, due to the distance from the Macondo spill site (435 miles or 700 km), it is unlikely that subsurface plumes have affected any benthic communities in or near the lease area, and therefore significant cumulative impacts are unlikely.

C.9.3 Cumulative Impacts to Socioeconomic Resources

The work planned in this RDOCD is limited in geographic scope and duration, and the impacts on socioeconomic resources will be correspondingly limited.

Archaeological Resources. AC 857 is not on the list of leases with a high potential for historic shipwrecks. The lease area is well beyond the 60-m (197-ft) depth contour used by the BOEMRE as the seaward extent for prehistoric archaeological site potential in the Gulf of Mexico. There will be no seafloor disturbance from anchoring because a DP semisubmersible and a platform rig will be used for drilling. Therefore, Shell's operations will have no cumulative impacts on historic shipwrecks or prehistoric archaeological resources.

Socioeconomic Resources. The multi-lease-sale EISs analyzed the cumulative impacts of oil and gas exploration and development in the lease area, in combination with other impact-producing activities, on commercial fishing, recreational fishing, recreational resources, historical and archaeological resources, land use and coastal infrastructure, demographics, and environmental justice (MMS, 2007b, pages 4-359 to 4-378). BOEMRE also analyzed the economic impact of oil and gas activities on the Gulf States, finding only minor impacts in most of Texas, Mississippi, Alabama, and Florida, more significant impact in parts of Texas, and substantial impact on Louisiana.

Shell's proposed activities will have negligible cumulative impacts on socioeconomic resources. There are no IPFs associated with routine operations that are expected to affect public health and safety, employment and infrastructure, recreation and tourism, land use, or other marine uses. The project will have negligible impacts on fishing activities.

New Information. The only new, potentially significant information available since preparation of the multi-lease-sale EISs is the Macondo spill. The spill has resulted in impacts on commercial and recreational fishing, recreation and tourism, employment, and public health and safety. The Macondo spill resulted in extensive fishery closures in the Gulf of Mexico, peaking at 34.8% of the U.S. EEZ in the Gulf of Mexico (NMFS, 2010c). The U.S. Travel Association has estimated the economic impact of the Macondo spill on tourism across the Gulf Coast over a 3-year period at $22.7 billion (Oxford Economics, 2010). Reported health impacts (e.g., among spill response and wildlife rehabilitation workers) ranged from cuts and scrapes, to upper respiratory symptoms and heat stress, to acute exposure to hydrocarbons or H_2S (Centers for Disease Control and Prevention, 2010a, 2010b; Solomon and Janssen, 2010). Most of these impacts were temporary in nature, although health exposure of clean-up workers could have longer-lasting impacts.

However, for all the reasons discussed in the RDOCD, Shell's NTL 2010-N06 response, the OSRP, and herein, the likelihood of a catastrophic well control event resulting in significant amounts of oil in the water is extremely remote. Therefore, Shell's proposed activities are not expected to result in any cumulative impacts to socioeconomic resources affected by the Macondo spill, nor should they have any impact on the previously-conducted cumulative impact analyses.

D. Environmental Hazards

D.1 Geologic Hazards

GEMS has prepared several geological and hazards reports for the lease area and adjacent blocks (GEMS, 2001, 2004, 2005a,b, 2007). The shallow hazards assessments conclude that the wellsites included in this RDOCD are suitable for the proposed activities. See **RDOCD Section 3** for supporting geological and geophysical information.

D.2 Severe Weather

Under most circumstances, weather is not expected to have any effect on the proposed activities. Extreme weather, including high winds, strong currents, and large waves, was considered in the design criteria for the drilling rig. High winds and limited visibility during a severe storm could disrupt communication and support activities (vessel and helicopter traffic) and make it necessary to suspend some activities on the drilling rig for safety reasons until the storm or weather event passes. In the event of a hurricane, procedures as outlined in the Hurricane Evacuation Plan would be adhered to.

D.3 Currents and Waves

A rig-based acoustic Doppler current profiler will be used to continuously monitor the current beneath the rig. Metocean conditions such as sea states, wind speed, ocean currents, etc. will also be continuously monitored. Under most circumstances, physical oceanographic conditions are not expected to have any effect on the proposed activities. Strong currents (e.g., caused by Loop Current eddies and intrusions) and large waves were considered in the design criteria for the drilling rig. High waves during a severe storm could disrupt support activities (i.e., vessel and helicopter traffic) and make it necessary to suspend some activities on the drilling rig for safety reasons until the storm or weather event passes.

E. Alternatives

No formal alternatives were evaluated in this EIA. However, various technical and operational options were considered by Shell in developing the proposed action including the location of wellsites and the selection of drilling units. The MMS (2007c) evaluated alternatives in the Grid EA for the Perdido development. There are no other reasonable alternatives to accomplish the goals of this project.

F. Mitigation Measures

The proposed action includes numerous mitigation measures required by laws, regulations, and BOEMRE lease stipulations and NTLs. The project will comply with all applicable Federal, state, and local requirements concerning air pollutant emissions, discharges to water, and solid waste disposal. All project activities will be conducted under Shell's OSRP and will include the measures described in **RDOCD Section 2j**. Additional pollution prevention measures, beyond those required by 30 CFR Part 250, include the following:

- Health, safety, and environment (HSE) are the primary topics in pre-tour and pre-job safety meetings. The discussion around no harm to people or environment is a key mindset. All personnel are reminded daily to inspect work areas for safety issues as well as potential pollution issues.
- All tools that come to and from the rig have their pollution pans inspected and cleaned, and plug installation confirmed prior to leaving the dock and prior to loading on the boat.
- Preventive maintenance of rig equipment includes visual inspection of hydraulic lines and reservoirs on a routine scheduled basis.
- All pollution pans on rig are inspected daily.
- Containment dikes are installed around all oil containment, drum storage areas, fuel vents, and fuel storage tanks.
- All used oil and fuel is collected and sent in for recycling.
- Every drain on the rig is assigned a number on a checklist. The checklist is used daily to verify drain plugs are installed.
- All trash containers are checked and emptied daily, and trash containers are kept covered. Trash is disposed of in a compactor and shipped in via boat.
- The rig is involved in a recycling program for cardboard, plastic, paper, glass, and aluminum.
- Fuel hoses are changed on annual basis.
- Spill prevention fittings are installed on all liquid take-on hoses.
- Waste paint thinner is recycled on board with a solvent to further reduce hazards of shipping and storage.
- All equipment on board utilizes Envirorite hydraulic fluid as opposed to hydraulic oil.
- Shell has obtained International Organization for Standardization (ISO) 14001 certification.
- Shell will use low sulfur fuel (0.05% by weight) to reduce air pollutant impacts.

G. Consultation

No persons or agencies were consulted regarding potential impacts associated with the proposed activities during the preparation of this EIA.

H. Preparers

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SECTION 19: ADMINISTRATIVE INFORMATION

A. Exempted Information Description (Public Information Copies Only)

The following attachments were excluded from the public information copies of this plan:

Section 1B OCS Plan Information form – Bottom hole locations & proposed total depth
Section 2J Blowout Scenario – confidential information for NTL 2015 N01 calculation
Section 3A Geologic Description
Section 3B Structure Contour Maps
Section 3C Interpreted 2D or 3D seismic line(s)
Section 3D Cross Section(s)
Section 3E Stratigraphic Column with Time vs. depth table

B. Bibliography

CSA Environmental Impact Analysis 2011

Geologic and Stratigraphic Assessment Report (Project Number 0600-271) for Shell on May 21, The report covers blocks 856, 857, 900, and 901 in Alaminos Canyon of the Gulf of Mexico.

Seafloor and Near-Surface Geologic Assessment (Project No. 0204-780). The report covers Blocks 812-14, 856-858, and 900-902 in Alaminos Canyon of the Gulf of Mexico.

Integrated Study of the Great White Development Area (Project No. 0105-945-d). The report covers Blocks 813, 814, 857 and 858.

Shallow Hazards, Multi-Temporal Subsidence Monitoring, and Archaeological Assessment, Perdido Field, Block 857 & Vicinity, Alaminos Canyon Area, Gulf of Mexico, August 2015" by Fugro Geoservices, Job No. 2414-5056 (being provided with this plan)

Shell's Regional OSRP

Oil Spill Response Discussion

A. Volume of the Worst Case Discharge

Please refer to Section 2j of this EP

B. Trajectory Analysis

Trajectories of a spill and the probability of it impacting a land segment have been projected utilizing information in the BOEMRE Oil Spill Risk Analysis Model (OSRAM) for the Central and Western Gulf of Mexico available on the BOEMRE website using 30-day impact. Offshore areas along the trajectory between the source and land segment contact could be impacted. The land segment contact probabilities are shown in Table 9.C.1.

Trajectory of a spill and the probability of it impacting a land segment have been projected utilizing Shell's WCD and information in the BSEE Oil Spill Risk Analysis Model (OSRAM) for the Central and Western Gulf of Mexico available on the SEE website using 30-day impact. The results are tabulated below.

Area/Block	OCS-G	Launch Area	Land Segment Contact	10 Day	30 Day
AC 857		11	Cameron, TX	1%	5%
			Willacy, TX	-	2%
			Kenedy, TX	1%	8%
			Kleberg, TX	1%	6%
			Nueces, TX	-	4%
			Aransas, TX	1%	5%
			Calhoun, TX	1%	6%
			Matagorda, TX	1%	10 %
			Brazoria, TX	-	2%
			Galveston, TX	-	3%
			Jefferson, TX	-	1%
			Cameron, LA	-	1%

Table 9.C.1 Probability of Land Segment Impact

C. Resource Identification

The locations identified in Table 9.C.1 are the highest probable land segments to be impacted using the BSEE Oil Spill Risk Analysis Model (OSRAM). The environmental sensitivities are identified using the appropriate National Oceanic and Atmospheric Administration (NOAA) Environmental Sensitivity Index (ESI) maps for the given land segment. ESI maps provide a concise summary of coastal resources that are at risk if an oil spill occurs nearby. Examples of at-risk resources include biological resources (such as birds and shellfish beds), sensitive shorelines (such as marshes and tidal flats), and human-use resources (such as public beaches and parks).

In the event an oil spill occurs, ESI maps can help responders meet one of the main response objectives: reducing the environmental consequences of the spill and the cleanup efforts. Additionally, ESI maps can be used by planners to identify vulnerable locations, establish protection priorities, and identify cleanup strategies.

The following is a list of resources of special economic or environmental importance that potentially could be impacted by WCD scenario.

Onshore/Nearshore: Matagorda County is identified as the most probable impacted County within the Gulf of Mexico for the Exploratory Worst Case Discharge. The Matagorda County has a total area of 1,612 square miles of which, 1,114 square miles of it is land and 498 square miles is water. Matagorda County includes two National Wildlife Refuges and one Wildlife Management Area including the Big Boggy National Wildlife Refuge, part of San Bernard National Wildlife Refuge, and the Mad Island Wildlife Management Area (WMA). The Big Boggy National Wildlife Refuge and San Bernard National Wildlife Refuge form a vital complex of coastal wetlands harboring more than 300 bird species. The Mad Island WMA is 5,700 acres and wildlife consists of a variety of different species. Key ESI maps for Plaquemines Parish and the legend are shown in Figures 9.C.1, 9.C.2, 9.C.3, 9.C.4, and 9.C.5.

Offshore: An offshore spill may require an Essential Fishing Habitat (EFH) Assessment. This assessment would include a description of the spill, analysis of the potential adverse effects on EFH and the managed species; conclusions regarding the effects on the EFH; and proposed mitigation, if applicable.

Significant pre-planning of joint response efforts was undertaken in response to provisions of the National Contingency Plan (NCP). Area Contingency Plans (ACPs) were developed to provide a well-coordinated response to oil discharges and other hazardous releases. The One Gulf Plan is specific to the Gulf of Mexico to advance the unity of policy and effort in each of the Gulf Coast ACPs. Strategies used for the response to an oil spill regarding protection of identified resources are detailed in the One Gulf Plan and relevant Gulf Coast ACP.

D. Worst Case Discharge Response

Shell will make every effort to respond to the Appomattox Worst Case Discharge as effectively as possible.
Since this scenario involves a surface blowout, an Adios model was run using a similar product. The results indicate 27% of the product would evaporated/ naturally dispersed on the surface of the water within 24 hours of discharge, leaving approximately 57,500 BOPD on the water.

Criteria	Calculations BOPD
TOTAL WORST CASE DISCHARGE (30 Day Average Rate)	79,100
Adios 2 Model Natural Surface Evaporation and Dispersion Results for 24 hours - 27%	21,357
TOTAL SPILL VOLUME REMAINING AFTER NATURAL SURFACE EVAPORATION AND DISPERSION	57,743

Table 9.D.1 Oil Remaining After Subsurface and Surface Dispersion

Shell has contracted OSROs to provide equipment, personnel, materials and support vessels as well as temporary storage equipment to be considered in order to cope with a WCD spill. Under adverse weather conditions, major response vessels and Transrec skimmers are still effective and safe in sea states of 6-8 ft. If sea conditions prohibit safe mechanical recovery efforts, then natural dispersion and airborne chemical dispersant application (visibility & wind conditions permitting) may be the only safe and viable recovery option.

MSRC OSRV	8 foot seas
VOSS System	4 foot seas
Expandi Boom	6 foot seas, 20 knot winds
Dispersants	Winds more than 25 knots, Visibility less than 3 nautical miles, or Ceiling less than 1,000 feet.

Table 9.D.2 Operational Limitations of Response Equipment

Upon notification of the spill, Shell would request a partial or full mobilization of contracted resources, including, but not limited to, skimming vessels, oil storage vessels, dispersant aircraft, subsea dispersant, shoreline protection, wildlife protection, and containment equipment. Following is a list of the contracted resources including de-rated recovery capacity, personnel, and estimated response times (procurement, load out, travel time to the site, and deployment). The Incident Commander or designee may contact other service companies if the Unified Command deems such services necessary to the response efforts.

Based on the anticipated worst case discharge scenario, Shell can be onsite with dedicated, contracted on water oil spill recovery equipment with adequate response capacity to contain and recover surface oil, and prevent land impact, within approximately 48 hours (based on the equipment's Estimated Daily Response Capacity (EDRC) and storage capacity). Shell will continue to ramp up additional on-water mechanical recovery resources as well as apply dispersants and in-situ burning as needed and as approved under the supervision of the USCG Captain of the Port (COTP) and the Regional Response Team (RRT).

Subsea Control and Containment: Shell, as a founding member of the MWCC, will have access to the IRCS that can be rapidly deployed through the MWCC. The IRCS is designed to contain oil flow in the unlikely event of an underwater well blowout, and is designed, constructed, tested, and available for rapid response. Shell's specific containment response for MC 767 will be addressed in Shell's NTL 2010-N10 submission at the time the APD is submitted.

Mechanical Recovery (skimming): Response strategies include skimming utilizing available OSROs Oil Spill Response Vessels (OSRVs), Oil Spill Response Barges (OSRBs), ID Boats, and Quick Strike OSRVs. There is a combined de-rated recovery rate capability of approximately 584,000 barrels/day. Temporary storage associated with the identified skimming and temporary storage equipment equals approximately 758,000 barrels.

	De-rated Recovery Rate (bopd)	Storage (bbls)
Offshore Recovery and Storage	550,401	743,606
Nearshore Recovery and Storage	344,578	15,279
Total	584,979	758,885

Table 9.D.3 Mechanical Recovery Combined De-Rated Capability

Table 9.D.4 Offshore On-Water Recovery and Storage Activation List
Table 9.D.5 Nearshore On-Water Recovery and Storage 5ctivation List

Oil Storage: The strategy for transferring, storing and disposing of oil collected in these recovery zones is to utilize two 150,000-160,000 ton (dead weight) tankers mobilized by Shell (or any other tanker immediately available). The recovered oil would be transferred to Motiva's Norco, LA storage and refining facility, or would be stored at Delta Commodities, Inc. Harvey, LA facility.

Aerial Surveillance: Aircraft can be mobilized to detect, monitor, and target response to oil spills. Aircraft and spotters can be mobilized within hours of an event.

Table 9.D.6 Aerial Surveillance Activation List

Aerial Dispersant: Depending on proximity to shore and water depth, dispersants may be a viable response option. If appropriate and approved, 4 to 5 sorties from three DC-3's can be made within the first 12 hour operating day of the response. These aerial systems could disperse approximately 7,704 to 9,630 barrels of oil per day. Additionally, 3 to 4 sorties from the BE90 King Air and 3 to 4 sorties from the Hercules C-130A within the first 12 hour operating day of the response could disperse 4,600 to 6,100 barrels of oil per day. For continuing dispersant operations, the CCA's Aerial Dispersant Delivery System (ADDS) would be mobilized. The ADDS has a dispersant spray capability of 5,000 gallons per sortie.

Table 9.D.8 Offshore Aerial Dispersant Activation List

Vessel Dispersant: Vessel dispersant application is another available response option. If appropriate, vessel spray systems can be installed on offshore vessels of opportunity using inductor nozzles (installed on fire-water monitors), skid mounted systems, or purpose-built boom arm spray systems. Vessels can apply dispersant within the first 12-24 hours of the response and continually as directed.

Table 9.D.9 Offshore Boat Spray Dispersant Activation List

Subsea Dispersant: Shell has contracted with Wild Well Control for a subsea dispersant package. Subsea dispersant application has been found to be highly effective at reducing the amount of oil reaching the surface. Additional data collection, laboratory tests and field tests will help in facilitating the optimal application rate and effectiveness numbers. For planning purposes, The system has the potential to disperse approximately 24,500 to 34,000 barrels of oil per day.

Table 9.D.10 Subsea Dispersant Package Activation List

In-Situ Burning: Open-water in-situ burning (ISB) also may be used as a response strategy, depending on the circumstances of the release. ISB services may be provided by the primary OSRO contractors. If appropriate conditions exist and approvals are granted, one or multiple ISB task forces could be deployed offshore. Task forces typically consist of two to four fire teams, each with two vessels capable of towing fire boom, guide boom or tow line with either a handheld or aerially-deployed oil ignition system. At least one support/safety boat would be present during active burning operations to provide logistics, safety and monitoring support. Depending upon a number of factors, up to 4 burns per 12-hour day could be completed per ISB fire team. Most fire boom systems can be used for approximately 8-12 burns before being replaced. Fire intensity and weather will be the main determining factors for actual burns per system. Although the actual amount of oil that will be removed per burn is dependent on many factors, recent data suggests that a typical burn might eliminate approximately 750 barrels. For planning purposes and based on the above assumptions, a single task force of four fire teams with the appropriate weather and safety conditions could complete four burns per day and remove up to ~12,000 bbls/day. In-situ burning nearshore and along shorelines may be a possible option based on several conditions and with appropriate approvals, as outlined in Section 19, In-situ Burn Plan (OSRP). In-situ burning along certain types of shorelines may be used to minimize physical damage where access is limited or if it is determined that mechanical/manual removal may cause a substantial negative impact on the environment. All safety considerations will be evaluated. In addition, Shell will assess the situation and can make notification within 48 hours of the initial spill to begin ramping up fire boom production through contracted OSRO(s). There are potential limitations that need to be assessed prior to ISB operations. Some limitations include atmospheric and sea conditions; oil weathering; air quality impacts; safety of response workers; and risk of secondary fires.

Table 9.D.11 In-Situ Burn Equipment Activation List

Shoreline Protection: If the spill went unabated, shoreline impact in St. Bernard or Plaquemines Parish, LA would depend upon existing environmental conditions. Nearshore response may include the deployment of shoreline boom on beach areas, or protection and sorbent boom on vegetated areas. Strategies would be based upon surveillance and real time trajectories provided by The Response Group that depict areas of potential impact given actual sea and weather conditions. Strategies from the New Orleans, Louisiana Area Contingency Plan, The Response Group and Unified Command would be consulted to ensure that environmental and special economic resources would be correctly identified and prioritized to ensure optimal protection. The Response Group shoreline response guides depict the protection response modes applicable for oil spill clean-up operations. Each response mode is schematically represented to show optimum deployment and operation of the equipment in areas of environmental concern. Supervisory personnel have the option to modify the deployment and operation of equipment allowing a more effective response to site-specific circumstances.

Table 9.D.12 Shoreline Protection and Wildlife Support List

Wildlife Protection: If wildlife is threatened due to a spill, the contracted OSRO's have resources available to Shell, which can be utilized to protect and/or rehabilitate wildlife. The resources under contract for the protection and rehabilitation of affected wildlife are in the following table:

Table 9.D.12 Shoreline Protection and Wildlife Support List

New or unusual technology in regards to spill, prevention, control and clean-up:
Shell will use our normal well design and construction processes with multiple barrier approach as well as new stipulations mandated by NTL 2008-N05. Response techniques will utilize new learnings from Macondo response to include in-situ burning and subsea dispersant application. Mechanical recovery advancements are continuing to be made to incorporate utilization of Koseq arms outfitted on barges, conversion of Platform Support Vessels for Oil Spill Response, and inclusion of nighttime spill detection radar to improve tracking capabilities (X-Band radar, Infrared sensing, etc.). In addition, new response technologies/techniques are continuing to be considered by Shell and the appropriate government organizations for incorporation into our planned response. Any additional response technologies/techniques presented at the time of response will be used at the discretion of the Unified Command and USCG.

Figure 9.C.1 Environmental Sensitivity Index Map Legend

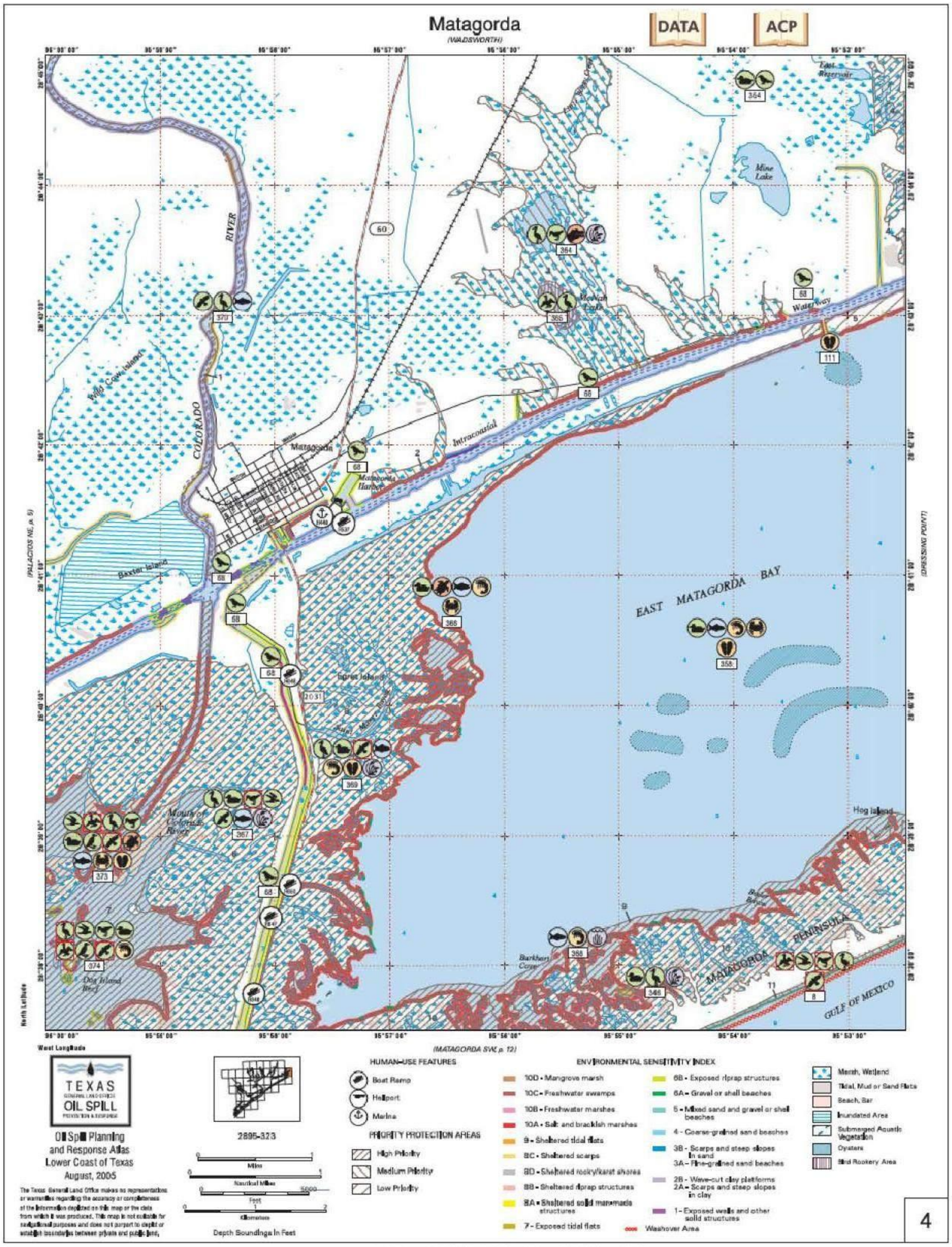

Figure 9.C.2 Matagorda ESI Map

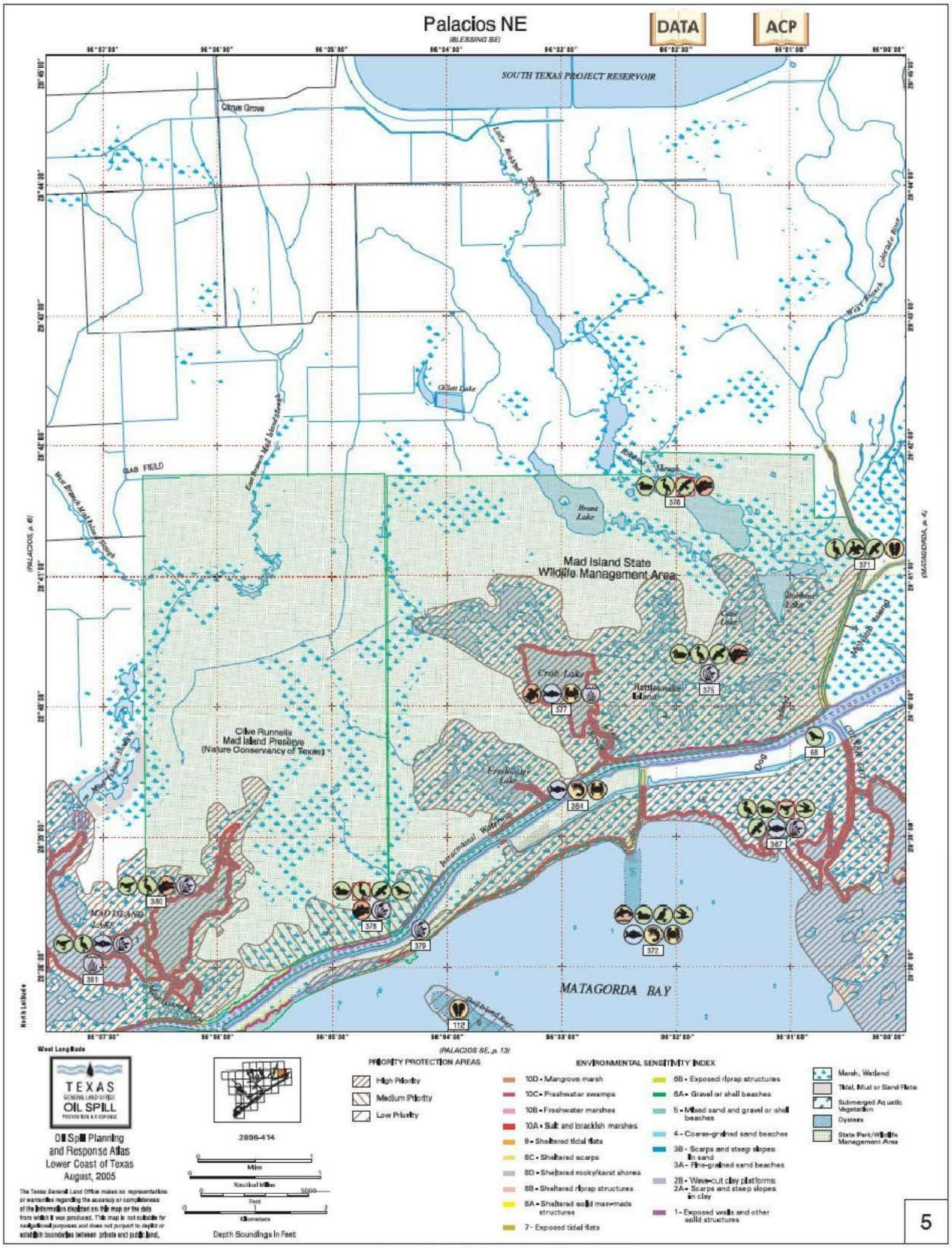

Figure 9.C.3 Palacios NE ESI Map

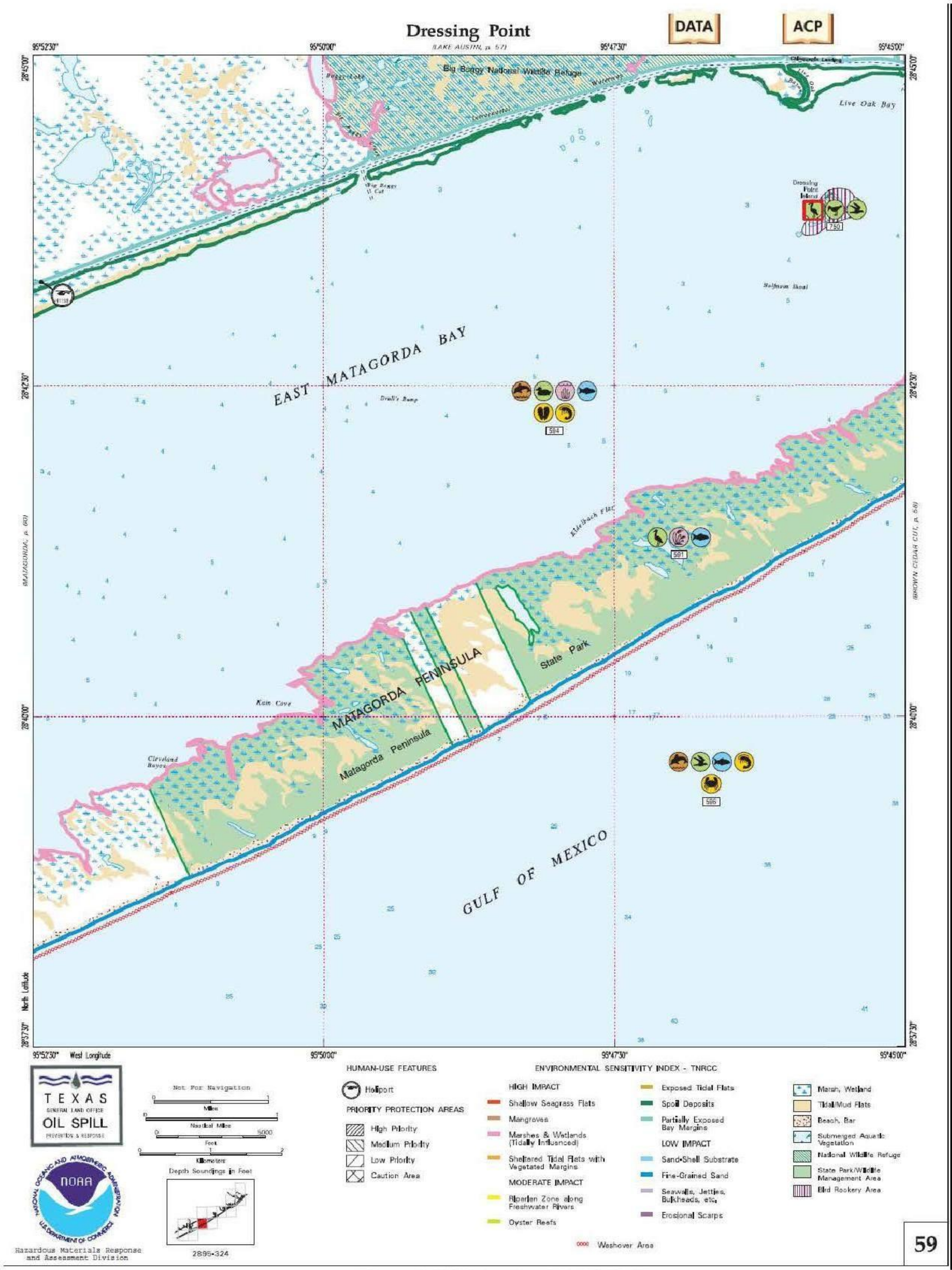

Figure 9.C.4 Dressing Point ESI Map

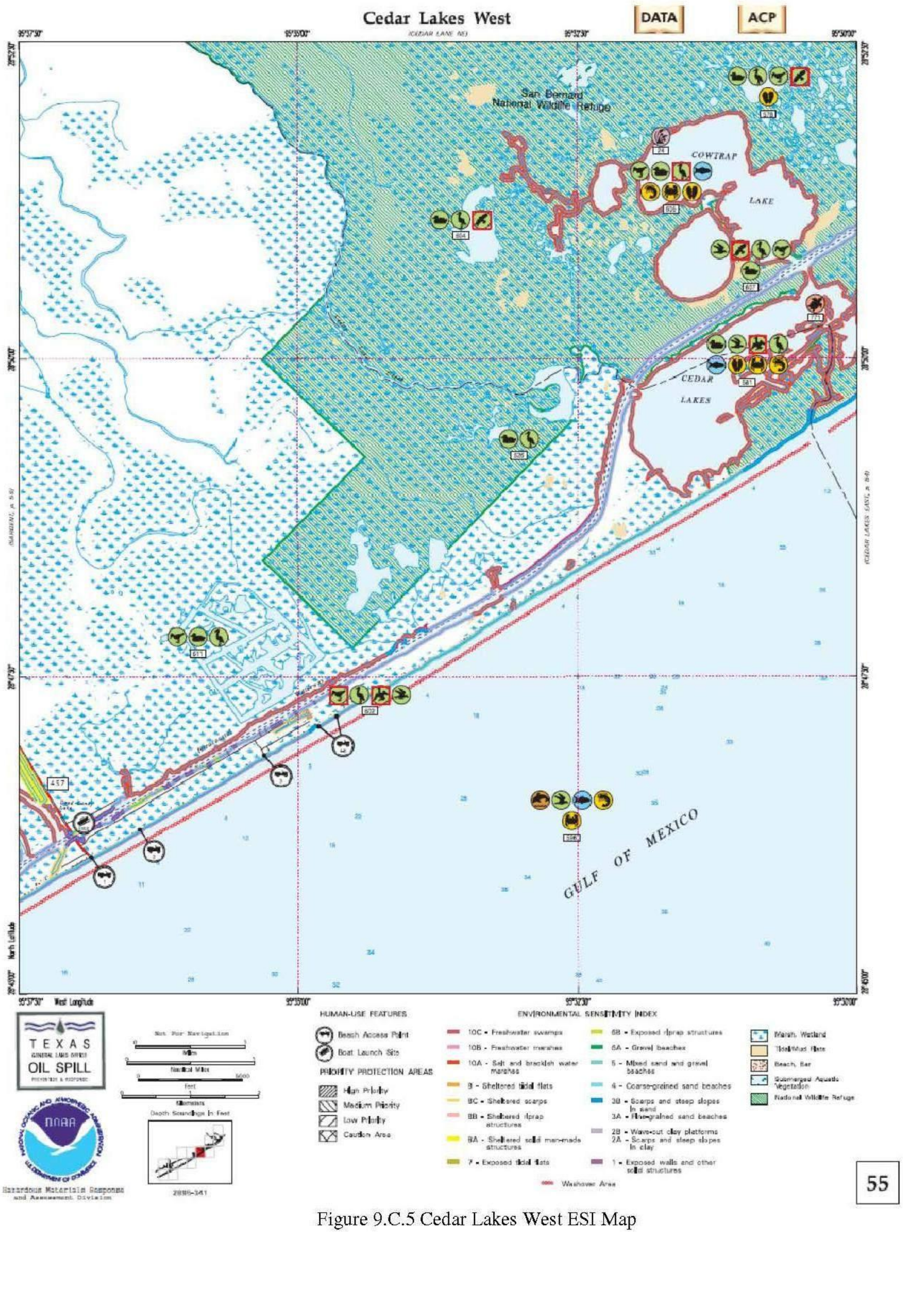

Figure 9.C.5 Cedar Lakes West ESI Map

AC 857 (Exploratory)
Offshore On-Water Recovery (Dedicated) Activation List

Skimming System	Supplier & Phone	Warehouse	Skimming Package	Quantity	Est. Derated Recovery Capacity (EDRC in Bbls/Day)	Storage (Barrels)	Staging Area	Distance to Site from Staging (Miles)	Response Times (Hours)				
									Staging ETA	Loadout Time	ETA to Site	Deployment Time	Total ETA
Southern Responder Transrec-350	MSRC 800-OIL-SPIL	Ingleside, TX	Transrec Skimmer	1	10,567	4,000	Ingleside, TX	190	2	1	13.5	1	17.5
			67" Boom	1980'									
			210' Vessel	1									
			Personnel	12									
			Tow Bladder	1									
FOILEX 250	MSRC 800-OIL-SPIL	Galveston, TX	Offshore Skimmer	1	3,977		Galveston, TX	200	2	1	14.5	1	18.5
			43" Offshore Boom	100'									
			Personnel	4									
			>110' Utility Boat	1									
			Towable Bladder	1		500							
Texas Responder Transrec-350	MSRC 800-OIL-SPIL	Galveston, TX	Transrec Skimmer	1	10,567	4,000	Galveston, TX	220	2	1	15.5	1	19.5
			67" Boom	2640'									
			210' Vessel	1									
			Personnel	12									
			32' Support Boat	1									
W-4	MSRC 800-OIL-SPIL	Galveston, TX	Offshore Skimmer	1	3,017		Galveston, TX	220	2	1	15.5	1	19.5
			67" Offshore Boom	330'									
			Personnel	4									
			Crew Boat	1									
			>110' Utility Boat	1									
			Towable Bladder	1		500							
GT-185	MSRC 800-OIL-SPIL	Galveston, TX	Offshore Skimmer	1	1,371		Galveston, TX	220	2	1	15.5	1	19.5
			67" Offshore Boom	330'									
			Personnel	4									
			Crew Boat	1									
			>110' Utility Boat	1									
			Towable Bladder	1		500							
GT-185	MSRC 800-OIL-SPIL	Galveston, TX	Offshore Skimmer	1	1,371		Galveston, TX	220	2	1	15.5	1	19.5
			67" Offshore Boom	330'									
			Personnel	4									
			Crew Boat	1									
			>110' Utility Boat	1									
			Towable Bladder	1		500							
Fast Response Unit "FRU"	CGA 888-CGA-2007	Galveston, TX	Don Wilson Skimmer	1	3,770	200	Galveston, TX	220	2	1	15.5	1	19.5
			43" Expandi Boom	500'									
			Personnel	4									
			Utility Boat	1									
			Crew Boat	1									
Koseq Skimming Arms (1)	CGA 888-CGA-2007	Galveston, TX	15m rigid skimming arm	2	17,829	0	Galveston, TX	220	2	1	15.5	1	19.5
			Personnel	4									
			Offshore vessel (>165')	1									
			30T crane	1									
			500 bbl Portable tank	4		2,000							
Koseq Skimming Arms (2)	CGA 888-CGA-2007	Galveston, TX	15m rigid skimming arm	2	17,829	0	Galveston, TX	220	2	1	15.5	1	19.5
			Personnel	4									
			Offshore vessel (>165')	1									
			30T crane	1									
			500 bbl Portable tank	4		2,000							
Koseq Skimming Arms (3)	CGA 888-CGA-2007	Galveston, TX	15m rigid skimming arm	2	17,829	0	Galveston, TX	220	2	1	15.5	1	19.5
			Personnel	4									
			Offshore vessel (>165')	1									
			30T crane	1									
			500 bbl Portable tank	4		2,000							

 10/27/2010

Table 9.D.4 Offshore On-Water Recovery Activation List

AC 857 (Exploratory)
Offshore On-Water Recovery (Dedicated) Activation List

Skimming System	Supplier & Phone	Warehouse	Skimming Package	Quantity	Est. Derated Recovery Capacity (EDRC in Bbls/Day)	Storage (Barrels)	Staging Area	Distance to Site from Staging (Miles)	Response Times (Hours): Staging ETA	Loadout Time	ETA to Site	Deployment Time	Total ETA
Koseq Skimming Arms (4)	CGA 888-CGA-2007	Galveston, TX	15m rigid skimming arm Personnel Offshore vessel (>165') 30T crane 500 bbl Portable tank	2 4 1 1 4	17,829	0 2,000	Galveston, TX	220	2	1	15.5	1	**19.5**
Koseq Skimming Arms (5)	CGA 888-CGA-2007	Galveston, TX	15m rigid skimming arm Personnel Offshore vessel (>165') 30T crane 500 bbl Portable tank	2 4 1 1 4	17,829	0 2,000	Galveston, TX	220	2	1	15.5	1	**19.5**
Koseq Skimming Arms (6)	CGA 888-CGA-2007	Galveston, TX	15m rigid skimming arm Personnel Offshore vessel (>165') 30T crane 500 bbl Portable tank	2 4 1 1 4	17,829	0 2,000	Galveston, TX	220	2	1	15.5	1	**19.5**
Koseq Skimming Arms (7)	CGA 888-CGA-2007	Galveston, TX	15m rigid skimming arm Personnel Offshore vessel (>165') 30T crane 500 bbl Portable tank	2 4 1 1 4	17,829	0 2,000	Galveston, TX	220	2	1	15.5	1	**19.5**
Koseq Skimming Arms (8)	CGA 888-CGA-2007	Galveston, TX	15m rigid skimming arm Personnel Offshore vessel (>165') 30T crane 500 bbl Portable tank	2 4 1 1 4	17,829	0 2,000	Galveston, TX	220	2	1	15.5	1	**19.5**
Koseq Skimming Arms (9)	CGA 888-CGA-2007	Galveston, TX	15m rigid skimming arm Personnel Offshore vessel (>165') 30T crane 500 bbl Portable tank	2 4 1 1 4	17,829	0 2,000	Galveston, TX	220	2	1	15.5	1	**19.5**
Koseq Skimming Arms (10)	CGA 888-CGA-2007	Galveston, TX	15m rigid skimming arm Personnel Offshore vessel (>165') 30T crane 500 bbl Portable tank	2 4 1 1 4	17,829	0 2,000	Galveston, TX	220	2	1	15.5	1	**19.5**
PT 150 Aquaguard Skimmer (1)	CGA 888-CGA-2007	Galveston, TX	brush skimmer Personnel Offshore vessel (>110') 500 bbl Portable tank	1 4 1 2	22,780	0 1,000	Galveston, TX	220	2	1	15.5	1	**19.5**
PT 150 Aquaguard Skimmer (2)	CGA 888-CGA-2007	Galveston, TX	brush skimmer Personnel Offshore vessel (>110') 500 bbl Portable tank	1 4 1 2	22,780	0 1,000	Galveston, TX	220	2	1	15.5	1	**19.5**
MSRC-403 Offshore Barge	MSRC 800-OIL-SPIL	Ingleside, TX	Offshore Barge 67" Offshore Boom Stress 1 Skimmer Personnel Offshore Tug	1 110' 1 4 1	15,840	40,300	Ingleside, TX	190	2	1	21	1	**25**
Gulf Coast Responder Transrec-350	MSRC 800-OIL-SPIL	Lake Charles, LA	Transrec Skimmer 67" Boom 210' Vessel Personnel 32' Support Boat	1 2640' 1 12 1	10,567	4,000	Lake Charles, LA	304	2	1	21.5	1	**25.5**
MSRC-570 Offshore Barge	MSRC 800-OIL-SPIL	Galveston, TX	Offshore Barge 67" Offshore Boom Stress 1 Skimmer Personnel Offshore Tug	1 110' 1 4 1	15,840	56,900	Galveston, TX	220	2	1	24.5	1	**28.5**
Fast Response Unit "FRU"	CGA 888-CGA-2007	Lake Charles, LA	Don Wilson Skimmer 43" Expandi Boom Personnel Utility Boat Crew Boat	1 500' 4 1 1	3,770	200	Lake Charles, LA	304	5.5	1	21.5	1	**29**
Stress 1	MSRC 800-OIL-SPIL	Lake Charles, LA	Offshore Skimmer 67" Offshore Boom Personnel Crew Boat >110' Utility Boat Towable Bladder	1 330' 4 1 1 1	15,840	500	Lake Charles, LA	304	5.5	1	21.5	1	**29**

 10/27/2010

Table 9.D.4 Offshore On-Water Recovery Activation List (continued)

AC 857 (Exploratory)
Offshore On-Water Recovery (Dedicated) Activation List

Skimming System	Supplier & Phone	Warehouse	Skimming Package	Quantity	Est. Derated Recovery Capacity (EDRC in Bbls/Day)	Storage (Barrels)	Staging Area	Distance to Site from Staging (Miles)	Response Times (Hours): Staging ETA	Loadout Time	ETA to Site	Deployment Time	Total ETA
MOSS Unit w/ GT-260	AMPOL 800-482-6765	New Iberia, LA	GT-260 Skimmer	1	2,743	50	New Iberia, LA	324	4	1	23	1	29
			36" Expandi Boom	720'									
			Personnel	4									
			110' Utility Boat	1									
			Crew Boat	1									
MOSS Unit w/ WP-4	AMPOL 800-482-6765	New Iberia, LA	Offshore Skimmer	1	3,565	50	New Iberia, LA	324	4	1	23	1	29
			36" Expandi Boom	720'									
			Personnel	4									
			110' Utility Boat	1									
			Crew Boat	1									
MOSS Unit w/ WP-4	AMPOL 800-482-6765	New Iberia, LA	Offshore Skimmer	1	3,565		New Iberia, LA	324	4	1	23	1	29
			36" Expandi Boom	720'									
			Personnel	4									
			110' Utility Boat	1									
			Crew Boat	1									
			Portable Tank	1		200							
MOSS Unit w/ WP-4	AMPOL 800-482-6765	New Iberia, LA	Offshore Skimmer	1	3,565		New Iberia, LA	324	4	1	23	1	29
			36" Expandi Boom	720'									
			Personnel	4									
			110' Utility Boat	1									
			Crew Boat	1									
			Portable Tank	1		200							
WP-1	AMPOL 800-482-6765	New Iberia, LA	Offshore Skimmer	1	1,440	200	New Iberia, LA	324	4	1	23	1	29
			36" Expandi Boom	720'									
			Personnel	4									
			110' Utility Boat	1									
			Crew Boat	1									
			Portable Tank	1									
GT-185	AMPOL 800-482-6765	New Iberia, LA	Offshore Skimmer	1	1,371	200	New Iberia, LA	324	4	1	23	1	29
			36" Expandi Boom	720'									
			Personnel	4									
			110' Utility Boat	1									
			Crew Boat	1									
			Portable Tank	1									
WP-3	AMPOL 800-482-6765	New Iberia, LA	Offshore Skimmer	1	2,880	200	New Iberia, LA	324	4	1	23	1	29
			36" Expandi Boom	720'									
			Personnel	4									
			110' Utility Boat	1									
			Crew Boat	1									
			Portable Tank	1									
M/V Recovery MOSS Unit w/ GT-185	AMPOL 800-482-6765	Fourchon, LA	GT-185 Skimmer	1	1,371	200	Fourchon, LA	354	2	1	25.5	1	29.5
			36" Expandi Boom	720'									
			Personnel	8									
			110' Utility Boat	1									
			Crew Boat - >65'	1									
M/V Responder MOSS Unit w/ Vikoma	AMPOL 800-482-6765	Cameron, LA	Vikoma SS-50 Skimmer	1	1,987		Cameron, LA	365	2	1	26	1	30
			36" Expandi Boom	720'									
			Personnel	8									
			110' Utility Boat	1									
			Crew Boat - >65'	1									
			50 bbl tank	4		200							
Fast Response Unit "FRU"	CGA 888-CGA-2007	Houma, LA	Don Wilson Skimmer	1	3,770	200	Houma, LA	365	2.5	1	26	1	30.5
			43" Expandi Boom	500'									
			Personnel	4									
			Utility Boat	1									
			Crew Boat	1									
Fast Response Unit "FRU"	CGA 888-CGA-2007	Houma, LA	Don Wilson Skimmer	1	3,770	200	Houma, LA	365	2.5	1	26	1	30.5
			43" Expandi Boom	500'									
			Personnel	4									
			Utility Boat	1									
			Crew Boat	1									
Fast Response Unit "FRU"	CGA 888-CGA-2007	Houma, LA	Don Wilson Skimmer	1	3,770	100	Houma, LA	365	2.5	1	26	1	30.5
			43" Expandi Boom	500'									
			Personnel	4									
			Utility Boat	1									
			Crew Boat	1									

 10/27/2010

Table 9.D.4 Offshore On-Water Recovery Activation List (continued)

AC 857 (Exploratory)
Offshore On-Water Recovery (Dedicated) Activation List

Skimming System	Supplier & Phone	Warehouse	Skimming Package	Quantity	Est. Derated Recovery Capacity (EDRC in Bbls/Day)	Storage (Barrels)	Staging Area	Distance to Site from Staging (Miles)	Response Times (Hours): Staging ETA	Response Times (Hours): Loadout Time	Response Times (Hours): ETA to Site	Response Times (Hours): Deployment Time	Total ETA
Louisiana Responder Transrec-350	MSRC 800-OIL-SPIL	Fort Jackson, LA	Transrec Skimmer 67" Boom 210' Vessel Personnel 32' Support Boat	1 2640' 1 12 1	10,567	4,000	Fort Jackson, LA	415	2	1	29.5	1	**33.5**
Mississippi Responder Transrec-350	MSRC 800-OIL-SPIL	Pascagoula, MS	Transrec Skimmer 67" Boom 210' Vessel Personnel 32' Support Boat	1 2640' 1 12 1	10,567	4,000	Pascagoula, MS	518	2	1	37	1	**41**
CGA-200 HOSS Barge (OSRB)	CGA 888-CGA-2007	Houma, LA	Belt Skimmer 43" Expandi Boom Personnel Tug - 1,200 HP Tug - 1,800 HP	1 2000' 8 2 1	43,000	4,000	Houma, LA	365	2	1	43	1	**47**
MSRC-452 Offshore Barge	MSRC 800-OIL-SPIL	Fort Jackson, LA	67" Inflatable Boom Offshore Barge Stress 1 Skimmer Personnel Offshore Tug	110' 1 1 4 1	15,840	45,000	Fort Jackson, LA	415	4	1	46	1	**52**
MSRC-402 Offshore Barge	MSRC 800-OIL-SPIL	Pascagoula, MS	Offshore Barge 67" Offshore Boom Stress 1 Skimmer Personnel Offshore Tug	1 110' 1 4 1	15,840	40,300	Pascagoula, MS	518	4	1	57.5	1	**63.5**
Florida Responder Transrec-350	MSRC 800-OIL-SPIL	Miami, FL	Transrec Skimmer 67" Boom 210' Vessel Personnel 32' Support Boat	1 2640' 1 12 1	10,567	4,000	Miami, FL	984	2	1	70.5	1	**74.5**
MSRC Offshore Tank Barge 360	MSRC 800-OIL-SPIL	Tampa, FL	67" Offshore Boom Offshore Barge Stress 1 Skimmer Personnel Tug - 3000 HP	110' 1 1 4 1	15,840	36,000	Tampa, FL	785	2	1	87	1	**91**

DERATED RECOVERY RATE (BBLS/DAY)	**476,365**
SKIMMING VESSEL STORAGE CAPACITY (BARRELS)	**273,400**

 10/27/2010

Table 9.D.4 Offshore On-Water Recovery Activation List (continued)

AC 857 (Exploratory)
Offshore On-Water Storage Activation List

Skimming System	Supplier & Phone	Warehouse	Skimming Package	Quantity	Est. Derated Recovery Capacity (EDRC in Bbls/Day)	Storage (Barrels)	Staging Area	Distance to Site from Staging (Miles)	Response Times (Hours)					
									Response time to Staging ETA	Loadout Time	ETA to Site	Deployment Time	Total ETA	
CTCo-5001 Offshore Barge	CGA 888-CGA-2007	Houma, LA	Offshore Barge Personnel Offshore Tug	1 4 1	N/A	45,000	Houma, LA	365	2	1	43	1	47	
CTCo-2606 Offshore Barge	CGA 888-CGA-2007	Houma, LA	Offshore Barge Personnel Offshore Tug	1 4 1	N/A	24,000	Houma, LA	365	2	1	43	1	47	
CTCo-2603 Offshore Barge	CGA 888-CGA-2007	Houma, LA	Offshore Barge Personnel Offshore Tug	1 4 1	N/A	24,000	Houma, LA	365	2	1	43	1	47	
CTCo-2605 Offshore Barge	CGA 888-CGA-2007	Houma, LA	Offshore Barge Personnel Offshore Tug	1 4 1	N/A	24,000	Houma, LA	365	2	1	43	1	47	
CTCo-2604 Offshore Barge	CGA 888-CGA-2007	Houma, LA	Offshore Barge Personnel Offshore Tug	1 4 1	N/A	22,500	Houma, LA	365	2	1	43	1	47	
CTCo-2601 Offshore Barge	CGA 888-CGA-2007	Houma, LA	Offshore Barge Personnel Offshore Tug	1 4 1	N/A	24,000	Houma, LA	365	2	1	43	1	47	
CTCo-2602 Offshore Barge	CGA 888-CGA-2007	Houma, LA	Offshore Barge Personnel Offshore Tug	1 4 1	N/A	24,000	Houma, LA	365	2	1	43	1	47	
CTCo-2404 Offshore Barge	CGA 888-CGA-2007	Houma, LA	Offshore Barge Personnel Offshore Tug	1 4 1	N/A	24,000	Houma, LA	365	2	1	43	1	47	
STORAGE CAPACITY (BARRELS)												211,500		
TOTAL STORAGE CAPACITY (INCLUDING SKIMMING VESSELS) (BARRELS)												484,900		

Table 9.D.5 Offshore On-Water Storage Activation List

AC 857 (Exploratory)
Nearshore On-Water Recovery Activation List

Skimming System	Supplier & Phone	Warehouse	Skimming Package	Quantity	Est. Derated Recovery Capacity (EDRC in Bbls/Day)	Storage (Barrels)	Staging Area	Distance to Site from Staging (Miles)	Response Times (Hours): Staging ETA	Loadout Time	ETA to Site	Deployment Time	Total ETA
MSRC "Quick Strike"	MSRC 800-OIL-SPIL	Ingleside, TX	LORI Brush Skimmer	1	5,000	50	Ingleside, TX	190	2	1	13.5	1	17.5
			Personnel	4									
			47' Fast Response Boat	1									
WP-1	MSRC 800-OIL-SPIL	Ingleside, TX	Offshore Skimmer	1	3,017		Ingleside, TX	190	2	1	13.5	1	17.5
			20" Boom	50'									
			Personnel	4									
			* Crew Boat	1									
			* Utility Boat	1									
			Towable Bladder	1		500							
CGA 58 Timbalier Bay	CGA 888-CGA-2007	Galveston, TX	Lori Brush Skimmer	1	5,000	65	Galveston, TX	220	1	0	15.5	1	17.5
			56" Boom	50'									
			46' Vessel	1									
			Personnel	4									
SBS w/ Queensboro	MSRC 800-OIL-SPIL	Galveston, TX	Offshore Skimmer	1	905	400	Galveston, TX	220	2	1	15.5	1	19.5
			20" Boom	50'									
			Personnel	4									
			* Push Boat	1									
			Towable Bladder	1									
M/V RW Armstrong	CGA 888-CGA-2007	Houma, LA	Lori Brush Skimmer	1	5,000	65	Houma, LA	365	1	0	26	0.5	27.5
			56" Boom	50'									
			46' Vessel	1									
			Personnel	4									
CGA-55 Egmopol Shallow Water Skimmer	CGA 888-CGA-2007	Galveston, TX	Egmopol Belt Skimmer	1	3,000	90	Galveston, TX	220	2	1	24.5	1	28.5
			18" Boom	100'									
			Personnel	3									
			34' Skimming Vessel	1									
			Shallow Water Barge	1		249							
SBS w/ Queensboro	MSRC 800-OIL-SPIL	Lake Charles, LA	Skimmer	1	905	400	Lake Charles, LA	304	5.5	1	21.5	1	29
			20" Boom	50'									
			Personnel	4									
			* Push Boat	1									

 10/27/2010

Table 9.D.6 Nearshore On-Water Recovery Activation List

AC 857 (Exploratory)
Nearshore On-Water Recovery Activation List

									Response Times (Hours)				
Skimming System	Supplier & Phone	Warehouse	Skimming Package	Quantity	Est. Derated Recovery Capacity (EDRC in Bbls/Day)	Storage (Barrels)	Staging Area	Distance to Site from Staging (Miles)	Staging ETA	Loadout Time	ETA to Site	Deployment Time	Total ETA
SBS w/ Queensboro	MSRC 800-OIL-SPIL	Lake Charles, LA	Offshore Skimmer	1	905	400	Lake Charles, LA	304	5.5	1	21.5	1	29
			20" Boom	50'									
			Personnel	4									
			* Push Boat	1									
			Towable Bladder	1									
SBS w/ Queensboro	MSRC 800-OIL-SPIL	Lake Charles, LA	Skimmer	1	905	500	Lake Charles, LA	304	5.5	1	21.5	1	29
			20" Boom	50'									
			Personnel	4									
			* Push Boat	1									
			Towable Bladder	1									
SBS w/ Queensboro	MSRC 800-OIL-SPIL	Lake Charles, LA	Offshore Skimmer	1	905	400	Lake Charles, LA	304	5.5	1	21.5	1	29
			20" Boom	50'									
			Personnel	4									
			* Push Boat	1									
			Towable Bladder	1									
SBS w/ Queensboro	MSRC 800-OIL-SPIL	Houma, LA	Skimmer	1	905		Houma, LA	365	2.5	1	26	1	30.5
			20" Boom	50'									
			Personnel	4									
			* Push Boat	1									
			Towable Bladder	1		400							
M/V Grand Bay	CGA 888-CGA-2007	Venice, LA	Lori Brush Skimmer	1	5,000	65	Venice, LA	404	1	0	29	1	31
			56" Boom	50'									
			46' Vessel	1									
			Personnel	4									
SBS w/ Queensboro	MSRC 800-OIL-SPIL	Ponce, Puerto Rico	Offshore Skimmer	1	905		Ingleside, TX	404	8	1	29	1	39
			67" Offshore Boom	660'									
			Personnel	4									
			Crew Boat	1									
			Utility Boat	1									
			Towable Bladder	1		500							
Queensboro	MSRC 800-OIL-SPIL	Ponce, Puerto Rico	Offshore Skimmer	1	905		Venice, LA	404	8	1	29	1	39
			67" Offshore Boom	660'									
			Personnel	4									
			Crew Boat	1									
			Utility Boat	1									
			Towable Bladder	1		500							
SBS w/ Queensboro	MSRC 800-OIL-SPIL	San Juan, Puerto Rico	Offshore Skimmer	1	905		Venice, LA	404	8	1	29	1	39
			67" Offshore Boom	660'									
			Personnel	4									
			Crew Boat	1									
			Utility Boat	1									
			Towable Bladder	1		500							

 10/27/2010

Table 9.D.6 Nearshore On-Water Recovery Activation List (continued)

AC 857 (Exploratory)
Nearshore On-Water Recovery Activation List

Skimming System	Supplier & Phone	Warehouse	Skimming Package	Quantity	Est. Derated Recovery Capacity (EDRC in Bbls/Day)	Storage (Barrels)	Staging Area	Distance to Site from Staging (Miles)	Response Times (Hours) Staging ETA	Loadout Time	ETA to Site	Deployment Time	Total ETA
SBS w/ Queensboro	MSRC 800-OIL-SPIL	Yabucoa, Puerto Rico	Offshore Skimmer	1	905		Venice, LA	404	8	1	29	1	39
			67" Offshore Boom	660'									
			Personnel	4									
			Crew Boat	1									
			Utility Boat	1									
			Towable Bladder	1		500							
SBS w/ AARDVAC	MSRC 800-OIL-SPIL	St Croix, VI	Offshore Skimmer	1	3,840		Venice, LA	404	8	1	29	1	39
			67" Offshore Boom	660'									
			Personnel	4									
			Crew Boat	1									
			>110' Utility Boat	1									
			Towable Bladder	1		500							
SBS w/ Queensboro	MSRC 800-OIL-SPIL	St Croix, VI	Offshore Skimmer	1	905		Venice, LA	404	8	1	29	1	39
			67" Offshore Boom	660'									
			Personnel	4									
			Crew Boat	1									
			Utility Boat	1									
			Towable Bladder	1		500							
SBS w/ Queensboro	MSRC 800-OIL-SPIL	Ponce, Puerto Rico	Offshore Skimmer	1	905		Venice, LA	404	8	1	29	1	39
			67" Offshore Boom	660'									
			Personnel	4									
			Crew Boat	1									
			Utility Boat	1									
			Towable Bladder	1		500							
Queensboro	MSRC 800-OIL-SPIL	Ponce, Puerto Rico	Offshore Skimmer	1	905		Venice, LA	404	8	1	29	1	39
			67" Offshore Boom	660'									
			Personnel	4									
			Crew Boat	1									
			Utility Boat	1									
			Towable Bladder	1		500							
SBS w/ Queensboro	MSRC 800-OIL-SPIL	San Juan, Puerto Rico	Offshore Skimmer	1	905		Venice, LA	404	8	1	29	1	39
			67" Offshore Boom	660'									
			Personnel	4									
			Crew Boat	1									
			Utility Boat	1									
			Towable Bladder	1		500							
SBS w/ Queensboro	MSRC 800-OIL-SPIL	Yabucoa, Puerto Rico	Offshore Skimmer	1	905		Venice, LA	404	8	1	29	1	39
			67" Offshore Boom	660'									
			Personnel	4									
			Crew Boat	1									
			Utility Boat	1									
			Towable Bladder	1		500							
SBS w/ AARDVAC	MSRC 800-OIL-SPIL	St Croix, VI	Offshore Skimmer	1	3,840		Venice, LA	404	8	1	29	1	39
			67" Offshore Boom	660'									
			Personnel	4									
			Crew Boat	1									
			>110' Utility Boat	1									
			Towable Bladder	1		500							

 10/27/2010

Table 9.D.6 Nearshore On-Water Recovery Activation List (continued)

AC 857 (Exploratory)
Nearshore On-Water Recovery Activation List

Skimming System	Supplier & Phone	Warehouse	Skimming Package	Quantity	Est. Derated Recovery Capacity (EDRC in Bbls/Day)	Storage (Barrels)	Staging Area	Distance to Site from Staging (Miles)	Response Times (Hours)				
									Staging ETA	Loadout Time	ETA to Site	Deployment Time	Total ETA
SBS w/ Queensboro	MSRC 800-OIL-SPIL	St Croix, VI	Offshore Skimmer 67" Offshore Boom Personnel Crew Boat Utility Boat Towable Bladder	1 660' 4 1 1 1	905	500	Venice, LA	404	8	1	29	1	**39**
SBS w/ Queensboro	MSRC 800-OIL-SPIL	Memphis, TN	Offshore Skimmer 20" Boom Personnel * Push Boat Towable Bladder	1 50' 4 1 1	905		Venice, LA	404	10	1	29	1	**41**
CGA-51 MARCO Shallow Water Skimmer	CGA 888-CGA-2007	Lake Charles, LA	Marco Belt Skimmer 18" Boom (contractor) Personnel 34' Skimming Vessel Shallow Water Barge	1 100' 3 1 1	3,588	20 249	Lake Charles, LA	304	5.5	1	34	1	**41.5**
SBS w/ GT-185	MSRC 800-OIL-SPIL	Pascagoula, MS	Skimmer 20" Boom Personnel * Push Boat Towable Bladder	1 50' 4 1 1	1,371	400	Pascagoula, MS	515	6	1	37	1	**45**
VOSS w/ AARDVAC	MSRC 800-OIL-SPIL	Pascagoula, MS	Skimmer 20" Boom Personnel * Utility Boat Towable Bladder	1 50' 4 1 1	3,840	500	Pascagoula, MS	515	6	1	37	1	**45**
VOSS w/ Queensboro	MSRC 800-OIL-SPIL	Pascagoula, MS	Skimmer 20" Boom Personnel * Utility Boat Towable Bladder	1 50' 4 1 1	905	500	Pascagoula, MS	515	6	1	37	1	**45**
CGA-53 MARCO Shallow Water Skimmer	CGA 888-CGA-2007	Houma, LA	Marco Belt Skimmer 18" Boom (contractor) Personnel 38' Skimming Vessel	1 100' 3 1	3,588	34	Houma, LA	365	4	1	40.5	1	**46.5**
CGA-54 Egmopol Shallow Water Skimmer	CGA 888-CGA-2007	Houma, LA	Belt Skimmer 18" Boom Personnel 38' Skimming Vessel Shallow Water Barge	1 100' 3 1 1	3,000	90 249	Houma, LA	365	4	1	40.5	1	**46.5**

 10/27/2010

Table 9.D.6 Nearshore On-Water Recovery Activation List (continued)

AC 857 (Exploratory)
Nearshore On-Water Recovery Activation List

Skimming System	Supplier & Phone	Warehouse	Skimming Package	Quantity	Est. Derated Recovery Capacity (EDRC in Bbls/Day)	Storage (Barrels)	Staging Area	Distance to Site from Staging (Miles)	Response Times (Hours): Staging ETA	Loadout Time	ETA to Site	Deployment Time	Total ETA
CGA-52 MARCO Shallow Water Skimmer	CGA 888-CGA-2007	Venice, LA	Marco Belt Skimmer	1	3,588	34	Venice, LA	404	2	1	45	1	49
			18" Boom (contractor)	100'									
			Personnel	3									
			36' Skimming Vessel	1									
			Shallow Water Barge	1		249							
WP-1	MSRC 800-OIL-SPIL	Tampa, FL	Offshore Skimmer	1	3,017		Venice, LA	404	15	1	29	1	46
			20" Boom	50'									
			Personnel	4									
			* Crew Boat	1									
			Towable Bladder	1		500							
M/V Bastian Bay	CGA 888-CGA-2007	Lake Charles, LA	Lori Brush Skimmer	1	5,000	65	Lake Charles, LA	304	1	0	21.5	1	23.5
			56" Boom	50'									
			46' Vessel	1									
			Personnel	4									
WP-1	MSRC 800-OIL-SPIL	Miami, FL	Offshore Skimmer	1	3,017		Venice, LA	404	19	1	29	1	50
			20" Boom	50'									
			Personnel	4									
			* Utility Boat	2									
			Towable Bladder	1		500							
Barge Boat w/ AARDVAC	MSRC 800-OIL-SPIL	Miami, FL	Offshore Skimmer	1	3,840		Venice, LA	404	19	1	29	1	50
			20" Boom	50'									
			Personnel	4									
			* Barge Boat	1									
			Towable Bladder	1		500							
Barge Boat w/ AARDVAC	MSRC 800-OIL-SPIL	Miami, FL	Offshore Skimmer	1	3,840		Venice, LA	404	19	1	29	1	50
			20" Boom	50'									
			Personnel	4									
			* Barge Boat	1									
			Towable Bladder	1		500							
SBS w/ Queensboro	MSRC 800-OIL-SPIL	Whiting, IN	Offshore Skimmer	1	905	400	Venice, LA	404	21	1	29	1	52
			20" Boom	50'									
			Personnel	4									
			* Push Boat	1									

 10/27/2010

Table 9.D.6 Nearshore On-Water Recovery Activation List (continued)

AC 857 (Exploratory)
Nearshore On-Water Recovery Activation List

Skimming System	Supplier & Phone	Warehouse	Skimming Package	Quantity	Est. Derated Recovery Capacity (EDRC in Bbls/Day)	Storage (Barrels)	Staging Area	Distance to Site from Staging (Miles)	Response Times (Hours): Staging ETA	Loadout Time	ETA to Site	Deployment Time	Total ETA
SBS w/ Queensboro	MSRC 800-OIL-SPIL	Toledo, OH	Offshore Skimmer	1	905	400	Venice, LA	404	22	1	29	1	53
			20" Boom	50'									
			Personnel	4									
			* Push Boat	1									
AARDVAC	MSRC 800-OIL-SPIL	Virginia Beach, VA	Offshore Skimmer	1	3,840		Venice, LA	404	23	1	29	1	54
			20" Boom	50'									
			Personnel	4									
			* Barge Boat	1									
			Towable Bladder	1		500							
SBS w/ Queensboro	MSRC 800-OIL-SPIL	Chesapeake City, MD	Offshore Skimmer	1	905	500	Venice, LA	404	27	1	29	1	58
			20" Boom	50'									
			Personnel	4									
			* Push Boat	1									
AARDVAC	MSRC 800-OIL-SPIL	Edison/Perth Amboy, NJ	Offshore Skimmer	1	3,840		Venice, LA	404	28	1	29	1	59
			20" Boom	50'									
			Personnel	4									
			* Barge Boat	1									
			Towable Bladder	1		500							
MSRC "Lightning"	MSRC 800-OIL-SPIL	Tampa, FL	LORI Brush Skimmer	1	5,000	50	Tampa, FL	785	2	1	56	1	60
			Personnel	4									
			47' Fast Response Boat	1									
SBS w/ Queensboro	MSRC 800-OIL-SPIL	Boston, MA	Offshore Skimmer	1	905	400	Venice, LA	404	32	1	29	1	63
			20" Boom	50'									
			Personnel	4									
			* Push Boat	1									
WP-1	MSRC 800-OIL-SPIL	Portland, ME	Offshore Skimmer	1	3,017		Venice, LA	404	35	1	29	1	66
			20" Boom	50'									
			* Utility Boat	1									
			Personnel	4									
			Towable Bladder	1		500							

DERATED RECOVERY RATE (BBLS/DAY)	106,993
SKIMMING VESSEL STORAGE CAPACITY (BARRELS)	17,224

** - These components are additional operational requirements that must be procured by OSROs in addition to the system identified.*

10/27/2010

Table 9.D.6 Nearshore On-Water Recovery Activation List (continued)

AC 857 (Exploratory)
Aerial Surveillance Activation List

Aerial Surveillance System	Supplier & Phone	Warehouse	Aerial Surveillance Package	Quantity	Staging Area	Distance to Site from Staging (nautical miles)	Response Times (Hours)			
							Staging ETA	Loadout Time	ETA to Site	Total ETA
Aero Commander Air Speed - 288	Airborne Support 985-851-6391	Houma, LA	Surveillance Aircraft	1	Houma, LA	349	2	0.25	1.21	**2.00**
			Spotter Personnel	2						
			Crew - Pilots	1						
Aero Commander Air Speed - 288	Airborne Support 985-851-6391	Houma, LA	Surveillance Aircraft	1	Houma, LA	349	2	0.25	1.21	**2.00**
			Spotter Personnel	2						
			Crew - Pilots	1						
Sikorsky S-92 Helicopter Air Speed - 137 knots	PHI 337-235-2452	Galveston, TX	Surveillance Aircraft	1	Galveston, TX	220	2	0.25	0.76	**2.00**
			Spotter Personnel	2						
			Crew - Pilots	2						
Sikorsky S-76 Helicopter Air Speed - 141 knots	PHI 337-235-2452	Galveston, TX	Surveillance Aircraft	1	Galveston, TX	220	2	0.25	0.76	**2.00**
			Spotter Personnel	2						
			Crew - Pilots	2						

Table 9.D.7 Aerial Surveillance Activation List

AC 857 (Exploratory)
Offshore Aerial Dispersant Activation List

Aerial Dispersant System	Supplier & Phone	Warehouse	Aerial Dispersant Package	Quantity	Staging Area	Distance to Site from Staging (Miles)	Response Times (Hours)				
							Staging ETA	Loadout Time	ETA to Site	Deployment Time	Total ETA
Aero Commander Air Speed - 288 MPH	Airbome Support 985-851-6391	Houma, LA	Aero Commander	1	Houma, LA	349	2	0.4	1.21	0.2	3.85
			Spotter Personnel	2							
			Crew - Pilots	1							
BT-67 (DC-3 Turboprop) Aircraft Air Speed - 194 MPH	Airbome Support 985-851-6391	Houma, LA	DC-3 Dispersant Aircraft	1	Houma, LA **1st Flight**	349	2	0.5	1.80	0.3	4.60
			Dispersant - Gallons	2000							
			Spotter Aircraft	1							
			Spotter Personnel	2	Ellington Field, TX **2nd Flight**	241	1.24	0.5	1.24	0.3	3.30
			Crew - Pilots	2							
DC-3 Aircraft Air Speed - 150 MPH	Airbome Support 985-851-6391	Houma, LA	DC-3 Dispersant Aircraft	1	Houma, LA **1st Flight**	349	2	0.5	2.33	0.3	5.15
			Dispersant - Gallons	1200							
			Spotter Aircraft	1							
			Spotter Personnel	2	Ellington Field, TX **2nd Flight**	241	1.61	0.5	1.61	0.3	4.05
			Crew - Pilots	2							
BE-90 King Air Aircraft Air Speed - 213 MPH	MSRC 800-OIL-SPIL	Stennis, MS	BE-90 Dispersant Aircraft	1	Stennis INTL., MS **1st Flight**	441	4.00	0.20	2.07	0.20	6.50
			Dispersant - Gallons	250							
			Spotter Aircraft	1							
			Spotter Personnel	2	Ellington Field, TX **2nd Flight**	241	1.13	0.20	1.13	0.20	2.70
			Crew - Pilots	2							
C130-A Aircraft Air Speed - 342 MPH	MSRC 800-OIL-SPIL	Coolidge, AZ	C130-A Dispersant Aircraft	1	Ellington Field, TX	241	8	0.3	0.70	0.5	9.55
			Dispersant - Gallons	3250							
			Spotter Aircraft	1							
			Spotter Personnel	2							
ADDS PACK Air Speed - 330 MPH	Clean Carribean 985-851-6391	Pt. Everglades, FL	C-130 Aircraft (contractor)	1	Clearwater, FL **1st Flight**	755	24-48	1	2.29	0.5	27.8 to 51.8
			ADDS PACK	1							
			Dispersant - Gallons	5000							
			Spotter Aircraft	1	Ellington Field, TX **2nd Flight**	241	0.73	0.3	0.73	0.5	2.26
			Spotter Personnel	2							
			Crew - Pilots	2							
ADDS PACK Air Speed - 330 MPH	Oil Spill Response +44 (0) 1224-72-6859	South Hampton, UK	L-382 Hercules Aircraft	1	Stennis INTL, MS **1st Flight**	441	6-24	2-4	1.34	0.5	9.85 to 29.85
			ADDS PACK	1							
			Dispersant - Gallons	5000							
			Spotter Aircraft	1	Ellington Field, TX **2nd Flight**	241	0.73	0.3	0.73	0.5	2.26
			Spotter Personnel	2							
			Crew - Pilots	2							
ADDS PACK Air Speed - 330 MPH	Oil Spill Response +44 (0) 1224-72-6859	Singapore, SG	L-382 Hercules Aircraft	1	Stennis INTL, MS **1st Flight**	441	6-24	2-4	1.34	0.5	9.85 to 29.85
			ADDS PACK	1							
			Dispersant - Gallons	5000							
			Spotter Aircraft	1	Ellington Field, TX **2nd Flight**	241	0.73	0.3	0.73	0.5	2.26
			Spotter Personnel	2							
			Crew - Pilots	2							

 10/27/2010

Table 9.D.8 Offshore Aerial Dispersant Activation List

AC 857 (Exploratory)
Offshore Boat Spray Dispersant Activation List

Boat Spray Dispersant System	Supplier & Phone	Warehouse	Boat Spray Dispersant Package	Quantity	Staging Area	Distance to Site from Staging (Miles)	Response Times (Hours) Staging ETA	Loadout Time	ETA to Site	Deployment Time	Total ETA
USCG SMART Team	USCG	Mobile, AL	Personnel * Crew Boat	4 1	Ingleside, TX	190	4	1	13.5	0.5	**19**
Fire Monitor Induction Dispersant Spray System	AMPOL 800-482-6765	Cameron, LA	Dispersant Spray System Dispersant (Gallons) Personnel * 110' Utility Boat * Crew Boat	1 500 4 1 1	Cameron, LA	270	2	0.5	19.5	1	**23**
Fire Monitor Induction Dispersant Spray System	AMPOL 800-482-6765	Fourchon, LA	Dispersant Spray System Dispersant (Gallons) Personnel * 110' Utility Boat * Crew Boat	1 500 4 1 1	Fourchon, LA	354	2	0.5	25.5	1	**29**
Skid-Mounted Dispersant Spray System	MSRC 800-OIL-SPIL	San Jose, PR	Dispersant Spray System Dispersant (Gallons) * 110' Utility Boat Personnel	1 880 1 12	Galveston, TX	220	16	1	15.5	1	**33.5**

** - These components are additional operational requirements that must be procured by OSROs in addition to the system identified.*

10/27/2010

Table 9.D.9 Offshore Boat Spray Dispersant Activation List

AC 857 (Exploratory)
Subsea Dispersant Package Activation List

Subsea Dispersant System	Supplier & Phone	Warehouse	Subsea Dispersant Package	Quantity	Staging Area	Distance to Site from Staging (Miles)	Response Times (Hours) Staging ETA	Loadout Time	ETA to Site	Deployment Time	Total ETA (hrs)
Subsea Dispersant Application System	Wild Well Control 281-784-4700	Houma, LA	ROV deployable Injection Wand (suited to single or double applicators)	1	Houma, LA	365	36-48	6-12	26.00	8-12	72 - 96
			1" x 100' High Pressure Whip Assembly	1							
			Coiled Tubing Unit	1							
			Injection Pumps	2							
			Subsea manifold w/ splitter	1							
			200 gallon dispersant resistant tanks	1							
			Positive pressure differential chemical separator	2							
			ROV								
			Crew	2							
			Vessel								

Table 9.D.10 Subsea Dispersant Package Activation List

AC 857 (Exploratory)
In-Situ Burn Equipment Activation List

Skimming System	Supplier & Phone	Warehouse	Skimming Package	Quantity	Staging Area	Distance to Site from Staging (Miles)	Response Times (Hours) Staging ETA	Loadout Time	ETA to Site	Deployment Time	Total ETA
ISB Fire-Fighting Team	TBD	TBD	* Offshore Firefighting Vessels	2	Venice, LA	404	TBD	1	29	1	**TBD**
			* Cranes	2							
			* Roll-off Boxes	2							
			Personnel	8							
			* Air Monitoring Equipment	2							
SMART In-Situ Burn Monitoring Team	USCG	Mobile, AL	* Air Monitoring Equipment	1	Venice, LA	404	TBD	1	29	1	**TBD**
			* Offshore Vessel	1							
			Personnel	4							
Safety Monitoring Team	TBD	TBD	* Air Monitoring Equipment	1	Venice, LA	404	TBD	1	29	1	**TBD**
			* Offshore Vessel	1							
			Personnel	4							
Wildlife Monitoring Team	TBD	TBD	* Air Monitoring Equipment	1	Venice, LA	404	TBD	1	29	1	**TBD**
			* Offshore Vessel	1							
			Personnel	4							
Aerial Spotting Team (per 2 ISB Task Forces)	TBD	TBD	Fixed Wing Aircraft	1	Venice, LA	404	TBD	1	29	1	**TBD**
			Trained ISB Spotter	2							
			ISB Documenter	1							
Fire Team (In-Situ Burn Fire System)	MSRC 800-OIL-SPIL	Galveston, TX	Fire Boom (ft)	500	Galveston, TX	220	2	1	15.5	1	**19.5**
			Guide Boom/Tow Line (ft)	400							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							
Fire Team (In-Situ Burn Fire System)	MSRC 800-OIL-SPIL	Miami, FL	Fire Boom (ft)	500	Ingleside, TX	190	16	1	13.5	1	**31.5**
			Guide Boom/Tow Line (ft)	400							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							
Fire Team (In-Situ Burn Fire System)	MSRC 800-OIL-SPIL	Pascagoula, MS	Fire Boom (ft)	500	Pascagoula, MS	518	2	1	37	1	**41**
			Guide Boom/Tow Line (ft)	400							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							
Fire Team (In-Situ Burn Fire System)	MSRC 800-OIL-SPIL	El Segundo, CA	Fire Boom (ft)	500	Ingleside, TX	190	34	1	13.5	1	**49.5**
			Guide Boom/Tow Line (ft)	400							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							

 10/27/2010

Table 9.D.11 In-Situ Burn Equipment Activation List

AC 857 (Exploratory)
In-Situ Burn Equipment Activation List

Skimming System	Supplier & Phone	Warehouse	Skimming Package	Quantity	Staging Area	Distance to Site from Staging (Miles)	Response Times (Hours) Staging ETA	Loadout Time	ETA to Site	Deployment Time	Total ETA
Fire Team (In-Situ Burn Fire System)	MSRC 800-OIL-SPIL	Chesapeake City, MD	Fire Boom (ft)	500	Venice, LA	404	27	1	29	1	58
			Guide Boom/Tow Line (ft)	400							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							
Fire Team (In-Situ Burn Fire System)	MSRC 800-OIL-SPIL	Edison, NJ	Fire Boom (ft)	500	Venice, LA	404	28	1	29	1	59
			Guide Boom/Tow Line (ft)	400							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							
Fire Team (In-Situ Burn Fire System)	MSRC 800-OIL-SPIL	St. Croix, USVI	Fire Boom (ft)	500	Ingleside, TX	190	48	1	13.5	1	63.5
			Guide Boom/Tow Line (ft)	400							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							
Fire Team (In-Situ Burn Fire System)	MSRC 800-OIL-SPIL	Port Angeles, WA	Fire Boom (ft)	500	Ingleside, TX	190	48	1	13.5	1	63.5
			Guide Boom/Tow Line (ft)	400							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							
Fire Team (In-Situ Burn Fire System)	MSRC 800-OIL-SPIL	Port Angeles, WA	Fire Boom (ft)	500	Ingleside, TX	190	48	1	13.5	1	63.5
			Guide Boom/Tow Line (ft)	400							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							
Fire Team (In-Situ Burn Fire System)	MSRC 800-OIL-SPIL	Portland, ME	Hydro Fire Boom (ft)	500	Venice, LA	404	35	1	29	1	66
			Guide Boom/Tow Line (ft)	400							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							
TOTAL FIRE BOOM AVAILABLE (FEET)											5,000

*** - These components are additional operational requirements that must be procured by OSROs in addition to the system identified.***

10/27/2010

Table 9.D.11 In-Situ Burn Equipment Activation List (continued)

AC 857 (Exploratory)
Shoreline Protection & Wildlife Support List

Supplier & Phone (MSRC Star Contractor)	Warehouse	Equipment Listing	Quantity	Staging Area	Distance to Site from Staging (Miles)	Response Times (Hours) Staging ETA	Loadout Time	ETA to Site	Deployment Time	Total ETA
ES&H Environmental 877-437-2634	Fourchon, LA	Containment Boom - 18" to 24"	1000'	Fourchon, LA	354	2	1	25.5	1	29.5
		Containment Boom - 6" to 10"	200'							
		Response Boats - 14' to 20'	3							
		Portable Skimmers	3							
		Response Personne	2							
USES Environmental 888-279-9930	Meraux, LA	Containment Boom - 18" to 24"	9000'	Fourchon, LA	354	3	1	25.5	1	30.5
		Containment Boom - 6" to 10"	1000'							
		Response Boats - 14' to 20'	13							
		Response Boats - 21' to 36'	5							
		Portable Skimmers	8							
		Response Personne	15 to 30							
USES Environmental 888-279-9930	Geismar, LA	Containment Boom - 18" to 24"	1000'	Fourchon, LA	354	3	1	25.5	1	30.5
		Response Boats - 14' to 20'	3							
		Portable Skimmers	2							
		Response Personne	9 to 18							
ES&H Environmental 877-437-2634	Houma, LA	Containment Boom - 18" to 24"	27,000'	Fourchon, LA	354	3	1	25.5	1	30.5
		Containment Boom - 6" to 10"	15,000'							
		Response Boats - 14' to 20'	38							
		Response Boats - 21' to 36'	12							
		Portable Skimmers	25							
		Shallow Water Skimmers	1							
		Bird Scare Cannons	200							
		Response Personne	11							
AMPOL 800-482-6765	Harvey, LA	Containment Boom - 18" to 24"	14750'	Fourchon, LA	354	3	1	25.5	1	30.5
		Response Boats - 14' to 20'	1							
		Response Personne	10							
AMPOL 800-482-6765	New Iberia, LA	Containment Boom - 18" to 24"	19000'	Fourchon, LA	354	4	1	25.5	1	31.5
		Response Boats - 14' to 20'	2							
		Response Boats - 21' to 36'	5							
		Portable Skimmers	6							
		Shallow Water Skimmers	1							
		Bird Scare Cannons	8							
		Response Personne	25							
Oilmop 800-645-6671	New Iberia, LA	Containment Boom - 18" to 24"	3,500'	Fourchon, LA	354	4	1	25.5	1	31.5
		Containment Boom - 6" to 10"	500'							
		Response Boats - 14' to 20'	6							
		Response Boats - 21' to 36'	1							
		Portable Skimmers	6							
		Shallow Water Skimmers	1							
		Bird Scare Cannons	20							
		Response Personne	8							
WR&E 281-731-8826	Houston, TX	Wildlife Specialist - Personnel	6 to 20	Ingleside, TX	190	3	1	13.5	0	17.5
MSRC 800-OIL-SPIL	Lake Charles, LA	Wildlife Trailer	1	Ingleside, TX	190	6	1	13.5	2	22.5
		Contract Truck (Third Party)	1							
		Personnel (Responder/Mechanic)	1							
WR&E 281-731-8826	Baton Rouge, LA	Wildlife Specialist - Personnel	6 to 20	Ingleside, TX	190	8	1	13.5	0	22.5
TRI-STATE 302-737-9543	Newark, DE	Wildlife Specialist - Personnel	6 to 12	Ingleside, TX	190	30	1	13.5	0	44.5

 10/27/2010

Table 9.D.12 Shoreline Protection and Wildlife Support List